Journal of the Royal Society of Arts

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FORTHCOMING MEETINGS

WEDNESDAY, 27TH JANUARY, at 2.30 p.m. FRED COOK MEMORIAL LECTURE. '*Four Representational Portrait Painters*', by Sir Gerald Kelly, K.C.V.O., PP.R.A. Anna Zinkeisen, R.O.I., R.D.I., a Member of Council of the Society, in the Chair. (The lecture will be illustrated by lantern slides.)

WEDNESDAY, 3RD FEBRUARY, at 2.30 p.m. SIR WILLIAM JACKSON POPE MEMORIAL LECTURE. '*Modern Dyes*', by Clifford Paine, B.Sc., F.R.I.C., a Director, Imperial Chemical Industries Ltd. Sir Charles Dodds, M.V.O., F.R.S., Courtauld Professor of Biochemistry, University of London, in the Chair. (The paper will be illustrated.)

FRIDAY, 5TH FEBRUARY, at 7.30 p.m. FILM EVENING. See programme on p. 163.

WEDNESDAY, 10TH FEBRUARY, at 2.30 p.m. '*The Art of Glass Engraving*', by Miss Helen Monro, M.A., of Edinburgh College of Art. Paul Reilly, Director, Council of Industrial Design, in the Chair. (The paper will be illustrated with lantern slides.)

THURSDAY, 11TH FEBRUARY, at **1.15 p.m.** COMMONWEALTH SECTION (Joint Meeting with the Royal Commonwealth Society, to be held at **18 Northumberland Avenue,** W.C.2). '*The Commonwealth Education Conference*', by Sir Philip Morris, K.C.M.G., C.B.E., M.A., Vice-Chancellor, Bristol University. Dame Mary Smieton, D.B.E., M.A., Permanent Secretary, Ministry of Education, in the Chair. (See separate Notice on p. 164.)

MONDAY, 15TH FEBRUARY, at 6 p.m. The first of three CANTOR LECTURES on '*The Fuel and Power Industries and National Prosperity*', by Albert Parker, C.B.E., D.Sc., F.R.I.C., lately Director of Fuel Research, D.S.I.R. (A syllabus for the lectures—which will be illustrated with lantern slides—appears on p. 162.)

WEDNESDAY, 17TH FEBRUARY, at 2.30 p.m. Symposium on '*The Training of British Staff for Overseas Posts*'. Speakers: W. H. Beeton, C.M.G., Training Officer, Overseas Service; B. F. Macdona, Barclays Bank (D.C.O.); A. R. Thomas, C.M.G., Assistant Under-Secretary of State, Colonial Office, and Dr. A. T. M. Wilson, Head of Unilever Training Division. A. R. N. Roberts, of Imperial Chemical Industries Ltd., and a Member of Council of the Society, in the Chair.

MONDAY, 22ND FEBRUARY, at 6 p.m. The second of three CANTOR LECTURES on '*The Fuel and Power Industries and National Prosperity*', by Dr. Albert Parker.

TUESDAY, 23RD FEBRUARY, at 5.15 p.m. COMMONWEALTH SECTION. SIR THOMAS HOLLAND MEMORIAL LECTURE. '*Voluntary Service Overseas*', by Alec Dickson, M.B.E., Project Adviser to Voluntary Service Overseas, and Secretary, Commonwealth Studies Committee, The Royal Commonwealth Society. Sir Hilary Blood, G.B.E., K.C.M.G., Chairman, Commonwealth Section Committee, in the Chair. (Tea will be served in the Library from 4.30 p.m.)

WEDNESDAY, 24TH FEBRUARY, at 2.30 p.m. TRUEMAN WOOD LECTURE. '*The Exploration of Outer Space*', by A. C. B. Lovell, O.B.E., F.R.S., Professor of Radio Astronomy, University of Manchester, and Director of Jodrell Bank Experimental Station. Oswald P. Milne, F.R.I.B.A., J.P., Chairman of Council of the Society, in the Chair.

MONDAY, 29TH FEBRUARY, at 6 p.m. The last of three CANTOR LECTURES on *The Fuel and Power Industries and National Prosperity*', by Dr. Albert Parker.

WEDNESDAY, 2ND MARCH, at 2.30 p.m. '*Scientific Methods in the Care of Works of Art*', by F. I. G. Rawlins, C.B.E., M.Sc., F.R.S.E., F.Inst.P., Deputy Keeper and Scientific Adviser to the Trustees, National Gallery.

FRIDAY, 11TH MARCH. The Film Evening announced in the separately printed programme has been cancelled. See Notice on p. 163.

WEDNESDAY, 16TH MARCH, at 2.30 p.m. FERNHURST LECTURE. '*Induced Mutations in Crop Plants—Prospects and Prospectives*', by D. Roy Davies, B.Sc., Ph.D., of Wantage Radiation Laboratory, Atomic Energy Authority. F. R. Horne, C.B.E., M.A., N.D.A., Director, National Institute of Agricultural Botany, in the Chair.

TUESDAY, 22ND MARCH, at 5.15 p.m. COMMONWEALTH SECTION. '*Changing Patterns of African Land-Use*', by William Allan, C.B.E., M.A., B.Sc., Senior Research Fellow, Department of Social Anthropology and Sociology, University of Manchester. (The paper will be illustrated with lantern slides. Tea will be served in the Library from 4.30 p.m.)

WEDNESDAY, 23RD MARCH, at 2.30 p.m. '*Modern Trends in Industrial Design*', by Sir Gordon Russell, C.B.E., M.C., R.D.I., lately Director, Council of Industrial Design. Oswald P. Milne, F.R.I.B.A., J.P., Chairman of Council of the Society, in the Chair. (The second of two papers; the first was read on 9th December.)

Fellows are entitled to attend any of the Society's meetings without tickets (except where otherwise stated), and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary. Official representatives of Companies in association with the Society may also attend with one guest.

SYLLABUS OF CANTOR LECTURES ON 'THE FUEL AND POWER INDUSTRIES AND NATIONAL PROSPERITY'

LECTURE I. Monday, 15th February. *World and National Energy Resources:* Energy utilization and its effect on productivity, national income, and standard of living; past and future trends and changes in utilization of fuel and power; efficiency, relative prices, and national expenditure on fuel and power.

LECTURE II. Monday, 22nd February. *Production and Treatment of Coals and Oils:* Types, qualities, and grades of size of bituminous coals and brown coals and selection for different uses; oil refining to provide products of different types for specific purposes.

LECTURE III. Monday, 29th February. *Natural and Manufactured Gas:* Treatment and distribution of natural gas for general use; production and use of coke from coal; manufacture of gas from coal, coke, and oils for industrial and domestic uses; distribution of gas; oils and chemicals from coals; chemicals from oil.

FILM EVENING

The last Film Evening of the Session will be held at the Society's House on Friday, 5th February, at 7.30 p.m., when the following films will be screened:

Kariba 1958
Kariba Game Rescue
Borgo a Mozzano
Team Work

Kariba 1958 (30 minutes), produced by the Central African Film Unit, is the colour film record of the second year's work on the Kariba Dam, which saw the completion of this project. Included in the film are some spectacular shots of the great Zambesi floods which seriously delayed construction and caused extensive damage to the works.

Kariba Game Rescue (10 minutes) shows the efforts made to rescue the game trapped by the rising waters as the vast lake behind the Dam began to fill up.

Borgo a Mozzano (28 minutes) is a colour film made by Shell Italiana. With some delightful photography, the film tells the story of an experiment in raising the standards of living at Borgo a Mozzano, a community of sixteen hamlets in Tuscany. The film will be introduced by Mr. Alan Deller, Public Relations Officer of the Shell Refining Co. Ltd.

Team Work (10 minutes) is a colour film recording the carving of a giant piece of sculpture made for erection outside the headquarters of Messrs. Taylor Woodrow Ltd. Mr. David Wynne, a Fellow of the Society, who was the sculptor, will introduce the film.

Tickets of admission are not required for this Film Evening and Fellows are entitled to introduce two guests. Light refreshments will be served in the Library afterwards.

N.B. Fellows are asked to note that in view of the Reception to be held at the Society's House on 3rd March, it has been decided to cancel the Film Evening which was announced in the separately printed programme of sessional arrangements as due to take place on 11th March.

COMMONWEALTH SECTION JOINT MEETING

The paper by Sir Philip Morris on 11th February, which is announced on p. 161 above, will be read to a joint meeting of this Society's Commonwealth Section and the Royal Commonwealth Society, to be held at the latter's headquarters in Northumberland Avenue, W.C.2. Fellows of the Royal Society of Arts wishing to attend will require special tickets, which may be obtained on application to the Secretary. These tickets will admit to the formal proceedings, which begin at 1.15 p.m. Fellows who wish to have a buffet luncheon (price 3*s.* 6*d.*) at the Royal Commonwealth Society beforehand, are asked to apply separately, at least 24 hours in advance, to Miss Poile, Social Organizer, at that Society.

ANNUAL RECEPTION

The price of tickets for the first Annual Reception, to be held at the Society's House on the evening of 3rd March, 1960, has now been fixed at £1 5*s.*, which will include buffet refreshments.

As announced in the last issue of the *Journal*, applications from Fellows for tickets will be met as they are received, until the accommodation is exhausted; a limited number of tickets, however, is being reserved for overseas Fellows visiting London, who are advised to make application as soon as possible.

The evening's arrangements will include a recital of music and a short film show. Full details will be supplied with the tickets.

AWARD OF THE BENJAMIN FRANKLIN MEDAL FOR 1960

With the approval of His Royal Highness the Duke of Edinburgh, President of the Society, the Benjamin Franklin Medal for 1960 has been awarded to Mr. Robert Nicholson, F.S.I.A., 'for skill in design'.

It will be remembered that this award (instituted in 1956 to commemorate the 250th anniversary of Benjamin Franklin's birth and the bicentenary of his election to membership of the Society) is made annually to 'individuals who have attained early distinction, with promise of future achievement, in the promotion of arts, manufactures and commerce'. The first recipient of the award was Professor F. C. Williams of Manchester University, 'for his contributions to electrical engineering'. In 1958 the medal was awarded to Mr. Peter Ustinov 'for his work in the field of drama', and in 1959 to Mr. H. G. Nelson, Managing Director of The English Electric Company Ltd., 'for his work in scientific industrial development'.

Mr. Robert Nicholson was born in Australia in 1920. His formative years were spent in this country, and he was educated at the Rochester Technical College and the Medway School of Art. Shortly after the last war, he entered into partnership with his brother Roger, and has since become well known for

his share in the design of several exhibitions of national significance, and of some notable interiors. Amongst the major commissions for exhibition design carried out by Robert Nicholson in association with his brother have been those for the South Bank Hobbies Room and Garden Pavilion at the 1951 Festival of Britain, the hall of the Design Centre in the Haymarket, London, and, more recently, 'The English Heritage' Exhibition at Jamestown, Virginia, in 1957. In the more general field of interior decoration (where the Nicholson partnership's range includes furniture, textiles and wall-paper) the present award also recognizes Robert Nicholson's contribution to the design of the Cotton Board's showrooms at the Colour Design and Style Centre in Manchester, and of the new London headquarters of the Wall Paper Manufacturers Ltd., and his part in the large scheme of redecoration completed in 1958 at the Caledonian Hotel, Edinburgh.

NEW LIST OF FELLOWS

A revised List of Fellows, corrected to 1st November, 1959, has now been published and can be obtained by Fellows, free, on application to the Registrar.

MEETING OF COUNCIL

A meeting of Council was held on Monday, 11th January. Present: Mr. Oswald P. Milne (in the Chair); Mrs. Mary Adams; Sir Hilary Blood; Sir Alfred Bossom; the Honble. G. E. C. Chubb; Sir Edward Crowe; Mr. R. E. Dangerfield; Mr. Geoffrey de Freitas; Sir George Edwards; Mr. P. A. Le Neve Foster; Mr. John Gloag; Sir Ernest Goodale; Professor R. Y. Goodden; Dr. Stanley Gooding; Mr. Milner Gray; Mr. Antony Hopkins; Mr. William Johnstone; Mr. Edgar Lawley; Lord Nathan; Mr. Paul Reilly; Sir Gilbert Rennie; Mr. A. R. N. Roberts; Sir Philip Southwell; Professor S. Tolansky; Mr. G. E. Tonge; Mr. Hugh A. Warren and Sir Griffith Williams; with Dr. K. W. Luckhurst (Secretary), Mr. G. E. Mercer (Deputy Secretary) and Mr. J. S. Skidmore (Assistant Secretary).

ELECTIONS

The following candidates were duly elected Fellows of the Society:

Allan, Thomas, Dundee, Angus, Scotland.
Beresford, Stanley, Nottingham.
Briggs, Herbert Denis, Newcastle-upon-Tyne.
Carrington, Roger Clifford, M.A., D.Phil., London.
Carter, William Henry Charles Philip, Ashford, Kent.
Castle, James Thomas, A.R.I.B.A., A.M.T.P.I., Reading.
Conesford, The Right Honble. Lord, Q.C., London.
Eddison, Christopher Richard, Broxbourne, Herts.
Elsbury, Edgar Bertram Harry, Oxshott, Surrey.
Fairclough, Bernard Deake, D.A., Darlington, Co. Durham.
Gifford, Michael St. John, Birkenhead, Cheshire.
Goss, Herbert Kingsley, St. Austell, Cornwall.

Hoyton, Edward Bouverie, R.S., Penzance, Cornwall.
Humphries, Gerald Leslie, Kidderminster, Worcs.
Hutton-Jamieson, Norman, Bukoba, Tanganyika, B.E. Africa.
Kocherthaler, Miss Mina, New York, N.Y., U.S.A.
Muller-Munk, Peter, B.A., Pittsburgh, Pa., U.S.A.
Nesbit, John Rowan, M.B.E., Currie, Midlothian, Scotland.
Nicholls, John Frank, London.
Orton, Mrs. L. Diana, B.A., L.R.A.M., London.
Parker, Alfred Cecil, Great Yarmouth, Norfolk.
Ponter, Anthony Barrie, B.Sc., Stourbridge, Worcs.
Radford, Christopher John, Beaumaris, Victoria, Australia.
Richmond, Henry William, F.S.A.(Scot.), Edinburgh.
Scott, Henry James, London.
Saunders, Alan Sylvian, A.T.D., Chesterfield, Derby.
Saunders, Edgar Francis, B.Sc., West Looe, Cornwall.
Smedley, Wallace Venables, Reigate, Surrey.
Urquhart, Ford Norman, M.R.A.I.C., Vancouver, British Columbia, Canada.
Wheeler, Dame Olive Annie, D.B.E., D.Sc., Cardiff.

The following were duly admitted as Institutions in union with the Society:

The College of Art and Crafts, Nottingham.
National Research Development Corporation, London.

The following Companies were admitted into association with the Society:

The British Electric Traction Company Ltd., London.
Courtaulds Ltd., London.
Kodak Ltd., London.
Woodall-Duckham Construction Company Ltd., London.

BENJAMIN FRANKLIN MEDAL FOR 1960

The Benjamin Franklin Medal for 1960 was awarded to Mr. Robert Nicholson, F.S.I.A. (See separate Notice on page 164.)

ANNUAL RECEPTION

Approval was given to proposed arrangements in respect of catering and entertainment at the Annual Reception on 3rd March. (See separate Notice on p. 164.)

CHRISTMAS CARD

It was reported that 34,000 copies of the Society's 1959 Christmas card had been sold. Preliminary consideration was given to the design of the 1960 card.

ARCHITECTS' REGISTRATION COUNCIL AND R.I.B.A.

Mr. Oswald P. Milne and Dr. R. W. Holland were reappointed as the Society's representatives on the Boards of Education of the Architects' Registration Council and the R.I.B.A. respectively.

OTHER BUSINESS

A quantity of financial and other business was transacted.

RECENT ADVANCES IN FOOD PRESERVATION

The Armstrong Memorial Lecture by

W. B. ADAM, M.A., F.R.I.C.,

Director, The Fruit and Vegetable Canning and Quick Freezing Research Association, delivered to the Society on Wednesday, 18th November, 1959, with W. V. Smedley, Chairman, Smedley's Ltd., in the Chair

THE CHAIRMAN: I feel privileged to take the Chair this afternoon. This is the fifth E. Frankland Armstrong Memorial Lecture to be delivered since its institution in 1951. Dr. Armstrong, who was a member of this Society for over twenty years, was one of its very few non-Royal Presidents. In 1943 he served as Chairman of its Council.

My formal job this afternoon, introducing our lecturer, is a task which gives me particular pleasure, because I have known Mr. Adam for more than thirty years, and in a way (if I may say so) his life and work have run somewhat parallel to my own. We both began to be engaged in the canning of fruit and vegetables when the industry first began to stir into life: Mr. Adam as a scientist and I as a manufacturer. He was born a Scot, but his native industry overcame his initial disability, and I am glad to say that for the last thirty years he has been passing himself off as a native of Gloucestershire. I have many pleasant recollections of work with him, and I can think of no one who could give a better picture of the subject that he has chosen.

The following lecture was then delivered.

THE LECTURE

Throughout the ages man has been faced with the problem of preserving food so as to carry over supplies from times of plenty to those of want. As conditions of living changed the driving force prompting him to seek out new methods of preservation was no longer the dire necessity of avoiding famine or malnutrition, but the lesser urge of convenience, through acquiring the ability to transport food unimpaired from country to town or continent to continent, and finally to present it in a form in which it could be prepared with ease and eaten with safety, benefit and enjoyment.

All foods in their natural state tend to deteriorate on storage, the chief agents of decomposition being yeasts, moulds and bacteria, and the primary aim of most methods of preservation is to destroy these micro-organisms or to produce conditions under which they cannot grow. Destruction is the object to be attained in canning and bottling, and also in some of the modern methods of irradiation. Inhibition of growth is aimed at in drying, salting, brining, curing, pickling, chilling, freezing and jam-making. Many of these are of great antiquity, notably drying and freezing. By the cultivation, harvesting and storage of cereals and legumes primitive man took advantage of the natural drying of seeds to a moisture

content below that at which micro-organisms can grow. Sun drying of fruit and fish has also long been practised in warmer countries. As man penetrated into high latitudes he took with him the skills in food preservation acquired during his apprenticeship in temperate climates and learnt also the value of cold in preserving meat and fruit.

As recently as two hundred years ago, during the great age of geographical exploration, sailors had to live largely on meat preserved by dry salting or brining and were only saved from the continual risk of scurvy by the discovery of the merits of lime juice and its introduction as part of the diet of British seamen. The lot of the landsman, as regards supplies of fresh meat during the winter months, was only a little less precarious than that of the sailor, for it was the custom to destroy all cattle other than breeding stocks during the autumn owing to shortage of winter fodder. It was against this background, in the closing years of the eighteenth century, that the first great discovery was made in the art of food preservation, when a method of heating food in sealed glass containers was introduced, to be followed very shortly by the use of the tinplate container. Canning is thus the oldest as well as the most widely used of the present methods of long-term preservation of foods. The use of low temperatures for the transportation and storage of food has advanced rapidly in recent years; quick freezing first came on the scene thirty years ago, while freeze-drying and irradiation are still in the early stages of their development.

CANNING AND QUICK FREEZING

It was in 1795 that a French confectioner named Nicholas Appert made his first successful experiments in the preservation of food in sealed containers by means of heat. In 1809 he earned an award of 12,000 francs from the French Government for his discovery and a year later published a book describing the methods he was using for the preservation of a number of foods. In the same year an Englishman named Peter Durand took out a patent for the use of a tinplate container for the preservation of food, and a year later the first cannery was started by Bryan Donkin at Bermondsey. In a few months' time we shall therefore be able to celebrate the 150th anniversary of the use of the tinplate container for the preservation of foods.

One more reference to the early history of canning and bottling is appropriate in the present circumstances, for the first description of a method of preserving foods by heat given to a British audience was contained in a paper by Thomas Saddington, entitled 'A Cheap Method of Preserving Fruit without Sugar for Home Use or Sea Stores', which he read at a meeting of the Society of Arts in 1808. In this he described a method of preserving fruit in bottles heated in a tank of water to 160°F., and it is of some interest to note that the heat processes he recommended are still used by many bottlers in this country.

Canning developed very slowly during the nineteenth century and its rate of advance only became rapid after the First World War, with the invention of fully automatic machinery for the fabrication and sealing of cans. In the United Kingdom the effect of these developments became apparent in the late 1920s

when the fruit and vegetable canning industry got under way, the annual output rising from three or four million cans in 1927 to about 1,500 million cans in 1958. The total production of canned fruit, vegetables, milk, soups, meat and fish in the United Kingdom has risen from about 600,000 tons to 1,000,000 tons during the past seven years, most of the increment being in canned vegetables, while during the past five years the consumption of canned fruit, vegetables, milk, meat and fish in the United Kingdom has risen from 42 lb. to 68 lb. per head of population per annum. These figures may appear, at first sight, to be small compared with the total weight of foods consumed, but they represent a valuable addition to the diet, both in variety and in nutritive value.

During the past forty years there has probably been more scientific and technical research done in connection with canning than in any other branch of the food industry. The most outstanding achievements have been in safeguarding public health, where the work of Karl Meyer thirty years ago on *Clostridium botulinum*—the only pathogenic micro-organism with spores of considerable heat resistance—led to the calculation of heat processes to be given to low-acid canned foods which have since been generally accepted. It is well to realize the degree of safety which the use of these processes affords the consumer and, in order to do this, it must be understood that there is theoretically no heat process which will guarantee that all bacterial spores infecting a foodstuff will be killed. Under conditions of moist heat spores of any one kind tend to be destroyed logarithmically, equal lengths of time at any temperature producing equal proportional reductions. Given a known initial infection with spores of a particular organism it is thus possible to calculate the probability that any can will contain a live spore after a known heat process. The recommended processing times used by vegetable canners in England and the U.S.A. are such that, if the average initial infection with the pathogenic organism *Clostridium botulinum* were as high as one spore per can, which is unlikely, only about one can in a million million would, after the process, contain a live spore which might germinate, grow and produce the toxin capable of causing botulism. This is a degree of improbability far greater than those conceived of in any list of hazards encountered in modern living, and is proved in practice by the fact that no case of botulism from foods produced in American or British canneries has been reported since these safeguards were introduced over thirty years ago.

Since the end of the Second World War great changes have taken place in the canning industry, but these have been less in the development of new types of packs than in the improvement of old ones. The speed of canning lines has been more than doubled, and a normal speed at the present time is about 200 cans a minute, while for homogenous packs such as soups and baby foods, speeds of 400 cans a minute are not uncommon. Another tendency in modern canning operations is to change from a batch system to a continuous one for processing vegetables, using either rotary or non-agitating automatic cookers in place of static retorts. In order to allow for still greater speeds of operation with elimination of mechanical valves and for a smoother gradation of temperatures and pressures before and after the heat process, a new type of cooker has been developed, in

which the cans do not pass directly into the pressure chamber through a transfer valve but travel down a hydrostatic column (which may be as high as 56 ft. for a processing temperature of 260°F.) and ascend a similar column at the end of the process. This matching of the conditions of temperature and pressure inside and outside the can, particularly during the cooling operations, reduces the risk of damage to the contents through surging caused by too rapid condensation of the headspace gases.

Much thought has been given, however, to other methods of heat transfer, including 'aseptic' canning in which the product—generally soup or milk—is presterilized in a heat exchanger and filled aseptically into sterile cans which are given no further heat treatment; 'end-over-end' processing in which heat is transferred rapidly by enforced convection through the rhythmical movement of the headspace gases in the can occasioned by carefully controlled speed of rotation; also hot-air sterilization, and flame sterilization in rotating cans. All these have certain merits but none has yet been found to be applicable to a wide variety of products or to a high speed of operation.

These developments within the canneries, great as they have been, are probably of less general interest than recent advances which have taken place in the cultivation and harvesting of crops used for this purpose. The impact of the fruit and vegetable canning industry on horticulture during the past 20 to 30 years has been considerable. Fruit canners in Britain take about 20 to 40 per cent of the gooseberry crop, 15 to 25 per cent of the strawberry crop, 12 to 20 per cent of the plum crop, 10 to 15 per cent of the cherry crop, and lesser proportions of other fruits. It is in the demand for peas, however, that canners and quick freezers have effected the greatest changes in the pattern of horticultural practice. In 1954 the acreage of green peas grown in the United Kingdom was about 66,000, of which 37 per cent were for canning or freezing. In 1958 the acreage had risen to about 94,000, of which 63 per cent were for processing. This indicates a marked change in the eating habits of the British public.

Green pea crops for canning or freezing are cut in the field and threshed through viners which may be placed adjacent to the factory, or at a convenient site in the area where the peas are grown. The most recent development is the mobile viner, which picks up a pea crop which had previously been cut and windrowed, threshes out the peas, and spreads the spent vines behind it as it moves across the field. A viner of this type can thresh out 20 to 30 cwt. of peas an hour. Crops of green beans can now be cut by a mechanical harvester which, under good conditions, can collect about 85 to 95 per cent of the total crop, the value of the remaining 5 to 15 per cent being offset against reduced costs compared with hand picking, but it is necessary to choose varieties which ripen uniformly and ones in which the beans do not interlace or trail on the ground. Machinery can also be used for harvesting carrots and spinach.

The introduction of mechanization into the harvesting of crops for canning and freezing can present a problem to the plant breeder, who may be called upon to produce new varieties or to modify old ones so as to meet special requirements in field or factory. The problem of breeding new varieties for a specific purpose,

such as canning or freezing, has, until recently, been studied solely from its practical aspects, but a more fundamental approach is now being considered. In this new method the question is posed whether there are any ascertainable relationships between chemical composition and quality and, if so, whether substances known to be advantageous can be introduced into new varieties and those known to be disadvantageous eliminated. A 'weeding out' of chemically unsuitable new varieties from plant breeders' selections could save years of unnecessary and tedious field trials and processing tests. Early work at the Campden Research Station along these lines has shown the reason why all varieties of broad beans except one are unsuitable for canning and that, in general, white flowered varieties of some vegetables give better results than ones with coloured flowers.

The selection of the variety of peas to be used is complicated by the fact that the characteristics required for canning are not quite the same as those needed for freezing, though certain 'dual purpose' varieties are acceptable. The most important quality in peas for both purposes is texture, and this is closely correlated with the state of maturity of the crop. Peas toughen and grow more mealy in texture as they ripen and it is important that the crop should be cut before these changes have advanced too far. Most canners and freezers in this country judge the stage of ripeness by testing the peas in a *tenderometer*, which measures the force required to push a sample of the peas through a standard grid. In some cases the processors purchase their peas from the grower on a sliding scale of price, based on tenderometer readings, the higher price paid for the less mature peas balancing the loss in yield due to earlier harvesting of the crop. Other instruments for judging the state of maturity of the crop—such as the *maturometer* and *texturemeter*—are occasionally used.

If the canning industry can claim to be 150 years old, with its main advance during the past forty years, the quick freezing industry can point with justifiable pride to a meteoric rise in as short a period as thirty years. The foundation of this industry rests on the work of Clarence Birdseye in the U.S.A. who first marketed quick frozen foods in 1929, and its success can be measured from the figure for the annual production of quick frozen foods in the United States, which is now more than two million tons. The development of quick freezing in the United Kingdom was interrupted by the Second World War, but is now in full stride. In its earlier years attention was given chiefly to the freezing of vegetables, the annual production of which in the United Kingdom is now 30,000 to 35,000 tons, and rising rapidly. The industry quick freezes about 25,000 tons of peas annually, which compares with about 40,000 to 45,000 tons for the longer established canning industry. It takes about 90,000 tons of white fish annually, giving a net weight of over 40,000 tons when packaged. Figures are not available for production of frozen meat, poultry and prepared foods in the United Kingdom, but these products are rapidly gaining popularity.

The essential feature of 'quick' freezing is that the time taken for the temperature of the food to fall from 32°F. to 25°F.—technically known as the 'zone of maximum crystal formation'—should be short. Rapid passage through

this zone results in the formation of small ice crystals, which cause less damage to the structure of the food than the larger crystals formed during slower freezing. There are several ways of freezing foods, but the commonest are blast freezing in air tunnels, and plate freezing. In the former the food is generally passed through the tunnel on trolleys, either in packages or on open trays. In plate freezing the packages are brought into contact with plates through which the refrigerant passes. In both cases the temperature used is generally about −30°F.

Few fundamental changes have been made recently in the methods of freezing foods, other than for some of the new specialized packs, but great advances have taken place in the presentation of the foods, and a wide range of packaging materials is now in use. Frozen food packages provide a much wider scope for the designer than does the more conventional can—a feature which is of great importance in this advertising age. The quick-freezing industry has not been slow to take advantage of the changing pattern of domestic life, with the housewife so often away from home on a job during the day, and the evening meal to be served with as little preparation as possible in front of the television set.

Quick-frozen foods present problems of transport, storage and display which are more complex than those associated with other types of foods, but improvements are continually being made which enable the necessary low temperatures to be maintained until the product is delivered to the consumer. There still appears to be a wide scope for development of frozen foods, provided quality can be maintained, and the present line of advance indicates that the industry is developing its own specialized markets rather than cutting into the existing markets for canned foods. Each type of food has its own particular merits, and the consumer continues to regard both with increasing favour.

REFRIGERATED STORAGE AND GAS STORAGE

Refrigeration is widely used in the transportation of food, such as fruit and meat, across seas and continents, and in the storage of home-grown fruit and imported food before distribution to the retail market. The general requirements to enable this to be done with reasonable success have been known for some time, and recent developments have been chiefly in the direction of obtaining better control of temperature and humidity in stores and ships' holds and in greater efficiency against heat transfer. The building of jacketed stores, the use of new insulating materials to replace cork, and the introduction of new methods of fixing the insulating materials to walls and ceilings are some of the developments which have taken place recently. There have also been changes in the methods of handling fruit both in the orchard and in store. Methods of 'bulk' handling promise to reduce damage and labour costs.

The importance of pre-cooling fruit before transport or marketing is being increasingly recognized, the methods used being air blast cooling, hydro-cooling and vacuum cooling. Improvements have been made in the types of insulated vans or containers used for transporting precooled fruit, and there is an increasing tendency to use CO_2 in transporting fresh fruit. The use of solid CO_2 in this

case is not associated primarily with the fall in temperature, but rather with inhibitory action on mould growth and on physiological changes in the fruit.

The capacity of refrigerated gas stores on English farms now amounts to about 12 million cubic feet (equivalent to about 100,000 tons) and is increasing by about four per cent per annum. Gas storage is now being used in the U.S.A. and elsewhere, but the emphasis in those countries is placed more on low concentrations of oxygen than on increased concentrations of CO_2. New substances are available to render stores gas-tight, and new methods have been developed to remove excess CO_2 from stores.

In spite of the advances made in recent years in the practice of refrigerated storage and gas storage, there still remains vast scope for fundamental research in this field.

It is still impossible accurately to define stage of ripeness, to say exactly at what stage fruit should be picked or to predict storage life or liability to storage disorders from a knowledge of chemical composition or physiological characteristics. Some progress is being made in the study of the effects of orchard treatments on chemical composition and also in the study of the respiration of fruits. The factors which affect the incidence of such physiological storage diseases as 'scald', 'brown heart', 'core flush' and low temperature breakdown are still not fully known. Methods for reducing losses from rotting are badly needed. These are some of the problems at present being studied at the Ditton Laboratory in Kent.

DEHYDRATION

The first drying of foods, other than by the sun's rays or by heating over a fire, is said to date from 1795, the same year as that in which Appert first learnt how to preserve foods by means of heat, when two other French experimenters dried sliced vegetables in a stream of air at 105°F. Since then a host of methods have been used, some requiring static driers, others rotary or belt driers, some requiring atmospheric pressures, others reduced pressures. The quality of many of the products dried by these older methods was not good enough to attract the civilian consumer, but the advantage of dried foods to the armed forces in saving shipping space made such products indispensable during wartime. Recent great technical advances have altered this situation materially, and it is estimated that about 50,000* tons of vegetables are now dehydrated each year in the United Kingdom, much of which goes to the civilian consumer.

Powders such as milk and coffee, and products of small particle size, such as soup and potato flakes, have an established market and, in some cases, an expanding one. A new method of drying citrus juices under a very high vacuum and at a relatively low temperature has resulted in powders which reconstitute very rapidly and compare favourably with the corresponding frozen concentrates.

The most striking advances in recent years have been in vacuum-drying and freeze-drying. Developments from Danish work led to a thorough study of vacuum-contact-drying at the Ministry of Agriculture, Fisheries and Food's

* A more recent estimate places this figure at 35,000 tons. W.B.A.

Research Establishment and Experimental Factory in Aberdeen. In this process the food is placed between hot plates in a vacuum chamber, contact of the upper and lower surfaces of the food with the plates being maintained throughout the drying operation by closing the gap between the plates as the food shrinks. The temperature of the plates falls during the drying cycle from 212°F. to about 140°F. The studies made in vacuum-contact-plate-drying have led to the development known as accelerated-freeze-drying, which represents the most advanced method of food dehydration known to-day. In this technique the food is frozen and then placed in the vacuum drying chamber (or it may be frozen *in situ* by evaporative cooling under vacuum) and it is then heated by contact with plates above and below. The ice inside the food passes directly from the solid to the vapour phase and is removed from the chamber. By this method meat can be dried in as short a time as five hours, and the products treated in this way reconstitute more rapidly and satisfactorily, with more natural flavour and better stability on storage than is possible by any method used up to now.

So far as can be ascertained at present, the cost of these products should not be more than that of equivalent quantities of quick frozen foods, and they have the advantage of not requiring low-temperature storage. The process is extremely versatile and can be applied to meat and fish in steak or fillet or minced form, and also to a wide range of vegetables and fruits.

IRRADIATION

During the past few years much energy and resource has been expended in an effort to preserve foods satisfactorily by irradiation. Success has been on a limited scale only, and chiefly confined to pasteurization rather than sterilization, and to the use of irradiation as a supplement to rather than a substitute for other methods of preservation. The sources of radiation used are either γ-rays from radioisotopes, or high-energy electrons discharged as a beam from a linear accelerator.

The unit for measuring the dose of ionizing radiation is termed the *rad* and the treatments given can conveniently be classified into three groups—Low Dose (up to 50,000 rad), Medium Dose (50,000 to 1 million rad) and High Dose (2 to 5 million rad). The Low Dose Treatments have been used successfully for the suppression of sprouting in potatoes and root crops and for the destruction of insect pests in grain and packaged products. Some success has been obtained with Medium Dose Treatments applied to foods to be stored at temperatures of 0° to 5°C., where the satisfactory storage life has been increased two- to five-fold. High Dose Treatments of sufficient intensity to produce an acceptable degree of sterility result in undesirable changes in flavour and texture.

Changes in flavour are the most frequent cause of failure of an irradiation process and, in some foods, these changes can occur at doses of less than 100,000 rad. Meat products are reported to develop off-flavours less readily if they have been preheated to destroy enzymes, and vegetables have to be blanched before irradiation for the same reason. Much work has been done on the radiation resistance of bacterial spores and it has been found that the spores of the most

dangerous food-poisoning organism, *Clostridium botulinum*, require about 400,000 rad to reduce their concentration to one-tenth. If it is agreed that the same degree of sterility is required for irradiated as for canned foods, and that the acceptable risk is of the order of one in 10^{12}, then the dose necessary to produce this factor of safety is nearly 5 million rad; half this dose is sufficient protection against other micro-organisms. At the moment there is little prospect that foods can be sterilized with doses much below these figures, or that the undesirable changes in flavour and texture resulting from such drastic treatment can be materially reduced. Nevertheless work on irradiation of foods continues on an increasing scale in universities and research institutes throughout the world, and in particular in the U.S.A. In Britain progress is being made in this field by the United Kingdom Atomic Energy Isotope Division at Wantage and by the Low Temperature Research Station at Cambridge.

Evidence obtained up to now suggests that irradiated foods are quite harmless, but it might take some time to convince the public of this fact and persuade them to accept foods preserved in this way. In the U.S.A. tens of thousands of animals have been fed diets compounded with a wide variety of irradiated foods. Considerable publicity has been given recently to a small number of isolated cases in which there have been changes noted in the normal physiological pattern of the animals. These abnormalities are being investigated. Quite apart from economic considerations it seems improbable that foods sterilized by irradiation will compete with canned or frozen foods in the foreseeable future.

ANTIBIOTICS

The use of antibiotics as food additives is not permitted at the present time in Great Britain; however, some relaxation of the regulations may be expected before long. The most important of the antibiotics under investigation can be placed in two groups (*a*) those which are not used therapeutically, and (*b*) those which are used for the treatment of disease. Nisin and subtilin may be included in the first group, aureomycin and terramycin in the second.

Nisin occurs naturally in some cheeses and is used in several countries to prevent bacterial growth in cheese. Studies made at the Campden Research Station have shown that the addition of very small quantities of nisin to canned vegetables can inhibit the germination and growth of spores of thermophilic bacteria and afford protection against possible souring of products when stored at high temperatures. The antibiotic would not be relied upon to control the growth of pathogenic organisms in canned vegetables, though it could be expected to afford this protection as well. Experiments made in the U.S.A. have shown that subtilin acts in a very similar manner to nisin.

Aureomycin and terramycin have no action on yeasts or moulds but can control the growth of a wide range of bacteria. In some countries (including the U.S.A.) these antibiotics are permitted for the treatment of eviscerated poultry, and an increase of up to 50 per cent in storage life has resulted from their use in the iced cooling water in which the birds are washed. Much heavier additions of the antibiotics to modified feeds given to poultry forty-eight hours before

slaughter can result in a substantial reduction in spoilage on subsequent storage under warm conditions. Treatment of this sort is permitted under existing British regulations as it is considered to be part of the feeding stuff and not an added preservative.

Experiments on the spraying or injection of meats with antibiotics have been successful in prolonging storage life, but no methods for commercial use have yet been approved. Antibiotics have also been used with some success in experiments on the control of deep spoilage of whales before processing and have been found to be beneficial when added to the iced water in which fish are stored soon after the catch.

Work on the use of antibiotics in foods is in progress at several research laboratories in the United Kingdom, including the Low Temperature Research Station at Cambridge and the Torry Research Station at Aberdeen.

CONCLUSIONS

It has not been possible, in the limited time available for this lecture, adequately to deal with all aspects of recent research and development in the preservation of food, but merely to indicate the main lines of advance. Canning and quick-freezing continue to increase in popularity and remain the chief methods used for long-term storage of foods. Refrigerated storage and refrigerated gas storage are so commonly accepted as a part of the everyday management of our daily food supply that they are easily overlooked or underrated in a review such as this. A method of preservation about which more will undoubtedly be heard in the near future is dehydration by accelerated-freeze-drying, and there may well be advances in the uses of antibiotics and in the pasteurization of foods by means of irradiation.

At the beginning of this lecture it was stated that the aim in developing any new method of preservation should be to produce an article which could be prepared with ease and eaten with safety, benefit and enjoyment. The need to fulfil the first of these is the more evident through the changing pattern of the duties of the modern housewife in her kitchen. The safety of the foods is guaranteed if the manufacturer makes use of the processes recommended by his research association and, in the case of quick-frozen foods, if the retailer ensures that the conditions of storage and sale are correct. A vast amount of research has gone into the problem of preserving foods so as to retain their full nutritive value and it is now possible to retain a high vitamin content in foods preserved by canning, quick-freezing or drying. Finally, it must be emphasized that foods have not only to be eaten but also enjoyed, and a major task of the food manufacturer must be to present his products in an attractive way and ensure that the flavour as well as the appearance will meet with the approval of the consumer.

It is 151 years since Thomas Saddington described to this Society a method of preserving fruit in bottles by means of heat, even assuring them that, if they had not 'an instrument for recording the temperature' of the water used for processing, they could use their finger to gauge the heat. In surveying the advances which have been made since his day one can hopefully echo the claim

he made for his own preserved fruits, that they would prove to be of 'general utility and luxurious benefit' to mankind.

DISCUSSION

MR. A. POWIS BALE: Speaking as one who co-operated with the food chemist as a chartered mechanical engineer, I think the lecturer has not quite done justice to the engineering side. He mentioned quite a famous engineer of the old days, Bryan Donkin, but nobody else.

I have two points. I have been engaged on a study of what you might call household efficiency, in other words the elimination of waste, and one type of waste is this ice which accumulates in an ordinary refrigerator, and which you have to de-ice—which is quite a bit of trouble. I have been looking round to find a use for this ice (you can quite easily get it half an inch thick in slabs round the low temperature box), and so far I have only been able to find a use for this to help my car batteries. I find this ice is as good as you could wish for in topping up car batteries. Now when you melt down the ice, is there any microbe contamination? I am not enough of a chemist to know. I can quite see it picking up grains of carbon from the atmosphere and things like that, but the water is quite clear and there seems to be no deposit. Would the lecturer express an opinion on this?

My other point concerns drying. He said it was not much used and not much fostered in the food industry. How about instant coffee and dried milk? That is an immense industry now, and they are excellent products. Dried milk started in New Zealand and gradually spread over the world. The machinery used in the most advanced part of dried milk is an enormous spray drier; you might say the base of the spray drier is bigger than the blackboard in this room, and the height about three times that height, and it is a wonderful apparatus.

THE LECTURER: I cannot, at the moment, think of any new uses for ice chipped from refrigerators, but using it for topping up batteries is not a bad idea. As far as micro-organisms are concerned, there is virtually no risk involved as harmful types do not grow at freezing temperatures. I believe I did make a brief reference to milk and coffee powders, and said that these were established examples of dehydration and, together with soups and potato powders and flakes, formed a large and expanding industry.

MR. D. HOLMES (J. Sainsbury Ltd.): With regard to quick frozen foods, the danger zone on cooling is 32 to 25 degrees and the optimum storage temperature is zero degrees. What temperature is dangerous in so far as storage is concerned, affecting the crystal structure of the product which is frozen?

THE LECTURER: This is rather difficult to answer, as crystal structure is not the only feature involved. Fruit and vegetables can be stored for quite a long time at temperatures of 10 or 15°F. without any very obvious changes taking place, but it should be realized that the velocity of some of the reactions involved increases tremendously as the temperature rises. A rise of 10°F. can increase some of the chemical changes about six-fold, which is much greater than in normal chemical reactions. Some of the rapid changes affected by rise in temperature include destruction of vitamin C and alterations in colour and flavour. Structural changes are less affected by slight rises in storage temperature. It is very desirable that the temperature should be maintained below 0°F. or −5°F. for most quick frozen foods. Nothing very obvious or serious is likely to happen if the temperature rises to about 10°F. for a few days, but a rise to above 20°F., even for a short time, can be serious, as it may affect the physical structure. Thawing and subsequent recrystallization must be avoided.

MR. A. H. WOOLLEN: I have heard that the Russians are using irradiation of potatoes on a commercial scale. Do you know anything about that?

THE LECTURER: I believe that is true, but I should like to ask a specialist, Mr. Ley, to answer.

MR. F. J. LEY (Technological Irradiation Group, Isotope Research Division, Wantage Radiation Laboratories, U.K.A.E.A.): Although there were reports that the Russians were marketing irradiated potatoes we have not been able to confirm them, and believe that the necessary nutritional studies are not yet complete. They have plans to irradiate large boxes of potatoes at the storage site and it seems quite economically feasible for them to do this.

COMMANDER M. B. F. RANKEN (Messrs. J. & E. Hall Ltd.): I think this question of temperature is important. Temperature must be related to the produce you are going to store. My particular field in recent years has been fish, and there we are tending to go much lower than 0° to −5°F. In fact, −20°F. is recommended by the Torry Research Station nowadays, and under those conditions we have had wonderful results with fish stored for as long as eighteen months or more. All modern cold stores for frozen fish are designed for this low storage temperature. The point is that a temperature of from 0° to −5°F. is probably all right for conditions in a shop or in the home where we are only keeping food for a short time, but it depends on the produce. On the other hand, we normally store meat in ships and ashore at + 10° to + 15°F. and this is perfectly satisfactory for long periods in storage. I think therefore it is very important to relate the temperature of storage to the produce and also to the length of time it is to remain in store.

MR. J. A. BREWSTER: I have done work on freeze drying and I have heard of work being done on it, over the last twelve years or more, but the usual result has been that the cost is far too high. The statement has now been made that it could very soon become a commercial possibility. My work was with large pieces of meat, such as a ham, and it was quite obvious that one of the most expensive things to maintain was a requisite vacuum. It was found that you would only achieve any satisfactory results with very thin layers of substance. Can the lecturer inform us what thickness of products can be freeze dried.

THE LECTURER: I do not know that I can give any direct answer to that. I have seen freeze drying in the Experimental Factory at Aberdeen, and as to the depth of the material, I should think it was about half to three-quarters of an inch dried. I did not see any larger pieces than that, and they were chiefly fillets of fish and meat, with a certain amount of minced meat and minced fish. The products were extremely good. For a long time the argument against freeze drying has been that it is a very costly business. I think it probably still is, but I have been assured that the cost will come down. It is quite likely that very large steaks and large pieces of meat cannot be dried quite as satisfactorily by this method.

MR. F. C. NORRINGTON: Will the lecturer explain why certain fatty packages put into a refrigerator will develop mould? My sister once said that it is because we put our food in greaseproof paper.

THE LECTURER: Whether or not food holds satisfactorily in a refrigerator depends on the temperature and time of holding. I am not sure whether the case referred to was storage for a few days or several weeks; if it were the latter, mould growth would be expected. As to the wrapping, one of the greatest faults is a purely practical one, for in foods left unwrapped the smell can be transferred from one food to another. Wrapping in many cases is highly advantageous for a short period; for longer periods taints can develop if food is left unwrapped.

MR. NORRINGTON: It does not happen when wrapped in a plastic bag.

DR. F. L. LEVY: As the storage life of frozen foods, in spite of constant temperature, is limited to between eight months and twelve months, depending on the variety of food and on the temperature, what would Mr. Adam recommend as an adequate test to decide whether the time has come to sell the food; in other words, whether it cannot stand any longer storage, or whether it still may be kept safely for another couple of months?

THE LECTURER: Safety is generally a matter of whether there has been any bacterial growth. Bacteria do not grow at temperatures appreciably below freezing point. For growth, with possible production of toxins, to occur, the temperature of the food must have been above freezing point at some time. Visual examination is probably as good a test as any for deciding the subsequent storage life. It is generally possible to tell by sight, taste and texture whether frozen food has been defrosted, but there is no simple test, other than a laboratory one, to ascertain whether there has been any bacterial growth.

MR. A. H. WOOLLEN: Can Mr. Adam tell us a little bit more about the chemical test for determining which varieties of beans are suitable for canning?

THE LECTURER: In some vegetables there is a connection between the colour of the flower and the composition of the seed coat. At Campden we made tests for leucoanthocyanins in broad bean seed and found that only one variety, which had a pure white flower, failed to give a positive reaction. All others, which had coloured flowers and contained leucoanthocyanins, were unsatisfactory for canning. White-flowered runner beans were better than scarlet runners. When I was in the United States last year I found a similar case where unsatisfactory results were being obtained with stringless beans of a variety which had coloured flowers. The reaction for leucoanthocyanin is a simple colour test. The red discoloration of apples, pears, gooseberries and other fruits on heating, which we are studying at present, is not due to the presence of leucoanthocyanin.

MR. NORRINGTON: Is there any way of improving de-canning? You get some cans where the flange is not wide enough to take most tin openers.

THE LECTURER: The answer is that the perfect can opener has yet to be made.

THE CHAIRMAN: It is now my pleasure and duty to propose a vote of thanks to Mr. Adam for his most interesting lecture.

The vote of thanks to the Lecturer was carried with acclamation and, another having been accorded to the Chairman upon the proposal of Dr. Stanley Gooding, the meeting then ended.

POWER PRODUCTION AND TRANSMISSION IN THE COUNTRYSIDE: PRESERVING AMENITIES

Two papers by

SIR CHRISTOPHER HINTON, K.B.E., F.R.S.,

Chairman, Central Electricity Generating Board

and

SIR WILLIAM HOLFORD, F.R.I.B.A.,

Professor of Town Planning, University College, London, and part-time Member of the Central Electricity Generating Board

read to the Society on Wednesday, 25th November, 1959, with the Rt. Honble. Lord Strang, G.C.B., G.C.M.G., M.B.E., Chairman, National Parks Commission, in the Chair

THE CHAIRMAN: As you know, our first speaker, Sir Christopher Hinton, is an engineer, and he has an engineer's job to do; but in my dealings with him I have found that he is sensitive to the claims of what are called amenities and I am sure that you will also find this when you hear him speak. Sir William Holford, as a Professor of Town Planning, has as one of his cares and concerns this very question of amenities. It is, I think, a welcome sign of the times that as such he should have been appointed by the Minister of Power to be a member of the Central Electricity Generating Board, which conducts one of the great sectors of the nationalized electricity industry. It is equally a sign of the times that in a recent piece of legislation the duty to have a care for the amenities has been laid upon the Generating Board. Sir William Holford in his capacity as a member of the Board will thus watch over the amenities; he will among other things, I suppose, do his best to see that there is a definite relationship between the works of man and the works of nature, and to see also that the one contributes to the other. We can therefore look forward to an interesting exposition of a subject which has very rightly and very healthily attracted a good deal of public attention lately.

The following papers were then read.

SIR CHRISTOPHER HINTON'S PAPER

No one should talk on any subject unless he has given it careful thought. When this thought has been given there are two conditions which justify talk; one is where the thought has led to conclusions which advance knowledge; the other is where no conclusion has been reached. It may then be reasonable to talk because the act of talking may pave the way for further thought and to a

solution. I talk about the problem of amenity in relation to electricity generation and transmission for the second and not for the first of these reasons.

In our context I define amenity as meaning the conditions in landscape which the public as a whole wishes to see and enjoy; it should be the aim of amenity planning to preserve or create these conditions. There is no doubt that the activities of the Central Electricity Generating Board often conflict with this amenity. The conflict tends to grow in magnitude and public opposition to the Board's schemes is increasing. The opposition is met mainly in relation to schemes for nuclear power plants and proposals for main transmission lines.

Nuclear power plants are opposed mainly because the present policy gives them a comparatively high degree of isolation. There is (perhaps excusably) some confusion of thought about the reasons for this isolation. In normal operation the plants which are at present being built cause no health hazard either within or outside the perimeter of the power station. Most careful thought is put into the design and construction of nuclear power plants and so far as human skill and knowledge can go these plants are judged to give rise to risks no greater than those which can arise from industry. As yet, however, there is little practical experience to test this skilled judgement; human skill is limited and based on knowledge which is not all-knowing. If human frailty leads to plant failure there must be a possibility that this failure would cause a release of fission products which might raise the level of radioactivity in the district immediately surrounding the power station to above the tolerance level. If this happened temporary evacuation of people in the affected district would be necessary, and the smaller the number of people affected the less is the disturbance caused. Such an occurrence is most highly improbable, but until more practical experience is available it is judged wise to place these power stations in areas where the density of population is sufficiently sparse to limit the inconvenience.

It should, however, be remembered that in the absence of a nuclear programme, development of conventional power stations would force the Generating Board to propose the construction of some of these conventional stations on sites not dissimilar from those which are being proposed for nuclear stations. The reasons for this lie in the facts that the modern station must be very large and that it requires a site having a combination of physical characteristics which is geographically uncommon. The Electricity Supply Industry has been growing over a long period, with the result that the best and least controversial sites have already been used. It is now exceptional to be able to find a suitable site in an urban area, and in the absence of nuclear power most new conventional power stations would have to be built in more rural surroundings with transmission lines to the load centres. Let us take as an example the major problem of supplying the rising demand of the Greater London area. Because of lack of sites in London itself and the vast quantities of cooling water needed by power stations, it would not be possible to meet the growing demand indefinitely by the construction of additional stations in the Thames Estuary. Stations already existing and under construction will raise the water temperature to a level which is near to the limit which is permissibly consistent with the avoidance of nuisance. Part of the

Home Counties and Outer London load is being met by the construction of additional stations on the Trent, where increasing supplies of coal are becoming available. This cannot be a complete solution because the cooling capacity of the Trent is even more limited than that of the Thames Estuary, and the stations there must also meet the growing demand of the Midlands. Moreover, transmission of electricity from the Midlands to the Home Counties is only cheaper than the transport of coal if the transmission lines can be reasonably fully loaded; in other words, long-distance transmission of the peak loads cannot be justified. The need for the construction of stations in the South-East would, therefore, unquestionably arise within the next few years. Deep water frontage on the Lower Thames Estuary is largely occupied by port facilities and oil installations, and whilst some additional generating capacity could probably be obtained there, the requirements of cooling water would force the Board to seek sites on the more open lengths of coast which have not been subject to general industrial development and which are regarded as amenity areas. In the absence of a nuclear programme there is little doubt that the construction of a conventional power plant in the Bradwell area would have been proposed within the next few years; the amenity problem arising in connection with the construction of power stations is not dependent entirely on the nuclear programme, and it should be remembered that nuclear stations which have no coal-stocking areas and no ash-disposal problems conflict less with amenity than conventional stations on similar sites.

The other main problem of amenity arises in connection with the construction of the high tension transmission network. In considering this problem it is necessary to differentiate between this network, using voltages of 132kV and upwards, and the smaller distribution lines at lower voltages which are used by the Area Boards. I do not imagine that the Area Boards would claim that their distribution lines are invariably ideal and that they never conflict with amenity. It seems to me, however, that where such offence is caused it is (because the poles and towers of these low tension distribution lines are so much less dominant than the pylons of the main transmission lines) an entirely different problem. The extent of the difference is similar to that between the offence caused by dropping litter in a rural area and the offence caused by putting up an ugly advertisement hoarding in the same area. In my view, the problem in relation to transmission lines is far more serious than that in relation to generating stations because the transmission lines spread in a country-wide network and are seen by far more people than will see the nuclear power stations. This opinion is supported by a comparison of the amount of opposition which is encountered in the two fields. A wise programme for construction of new main transmission lines should allow an overall time of four or even five years, three years or even more of this time being spent in negotiating the route. Such long delay is bound to make network planning less accurate and efficient.

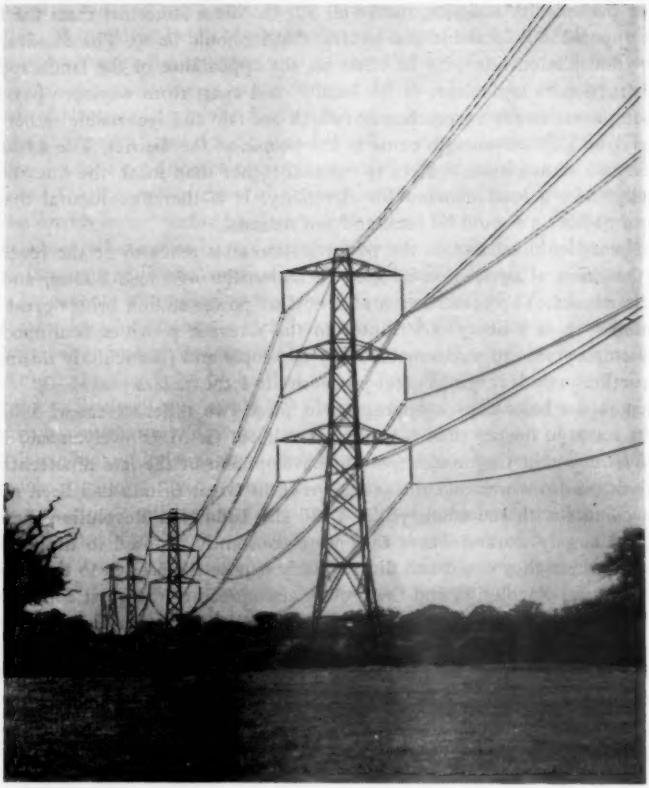
In connection with transmission lines the focus of opposition is mainly local and arises primarily from landowners who do not wish to have the inconvenience of pylons on agricultural land, from householders in the immediate vicinity, from planning officers and from local authorities who are anxious to preserve

amenity. In some cases these local interests call to their support national bodies such as the amenity societies, but in all but the more abnormal cases the focus of the opposition is local and it is natural that it should be so. The disadvantage of the transmission line with its effect on the appearance of the landscape and its obstruction to agriculture is felt locally, and apart from wayleave payments and compensation for encroachment (which are fair and reasonable rather than princely) no local advantages come to the people of the district. The advantage of the main transmission system is national rather than local, the lines do not normally meet a local demand for electricity. It is therefore natural that the focus of objection should be local and not national.

The position in relation to the power station sites tends to be the reverse of this; the focus of opposition is often in nationally organized bodies, and this again is natural. The construction of a nuclear power station brings great local advantages; it is a heavy contributor to the rates; it provides continued and steady employment to a reasonable body of people and (particularly during the construction period) it brings great prosperity to local traders.

What is the basis of this opposition in these two different cases? I believe that its roots go deeper than is generally realized. G. M. Trevelyan said in his *Social History* that the most important development of the late nineteenth and twentieth centuries was that the average man in Great Britain had been robbed of his contact with the countryside. Until the Industrial Revolution men had lived and largely worked where they were constantly exposed to the forces of nature or where they could and did regularly expose themselves to these forces. The Industrial Revolution and the growth and spread of the great conurbations have robbed a large proportion of the population of this contact with unspoiled nature. Deep down in their minds I believe that most men feel this loss; the only compensation of the town-dweller lies in escape at weekends or holidays into a countryside where he is away from man-made works which are of such a scale and concentration as to oppress him with a sense of domination; and he sees this escape becoming, yearly, more difficult.

If this is true it is important and it makes our problem more difficult. The site which is chosen for a nuclear power plant to supply the London load economically is also within reasonable weekend travelling distance of London. The fact that it is not outstandingly beautiful is of little importance because by policy it is isolated and undeveloped. It is of immense value because even though it is unbeautiful it is a spot to which the man yearning to free himself from the oppression of the London conurbation (I use the word purposely because it is as ugly as the fact) is able to escape. I do not believe that the man who fishes from the beach at Dungeness at the weekend worries that Dungeness is essentially featureless. In a cold easterly wind he feels that he is exposing himself to natural forces which are remote from him during most of his waking and sleeping hours. The lighthouse does not dominate him; it is there to help men who are more exposed to nature than he is. The ugly little temporary bungalows do not dominate him; from the beach he may not see them, and if he does, their frailty is such that they do not challenge nature.



275 kV Elstree-Tilbury transmission line, near Ridge

If this is so it is no use to claim that on the featureless promontory of Dungeness a nuclear power plant will provide a dominating and challenging feature and so will improve the character of that headland. The man who goes to Dungeness does so because nothing challenges him there other than nature and the last thing that he wants is a challenge from a man-made structure, however magnificent.

Similarly it is no use to argue that properly sited pylons and transmission lines stride grandly across the countryside. To the average man they are (consciously or sub-consciously) the tentacles of industrialization creeping out into a countryside which he would prefer to keep free from industrialization, and giving constant reminder of the continuous growth and spread of that industrialization. He will not welcome the transmission line striding, however grandly,

across country however dull, if at the bottom of his heart he fears the constant growth and spread of industrialization.

It is not surprising that objection along these lines is seldom raised at the inquiries which are held into proposals for siting power stations or transmission lines. Although I believe that the roots of objection lie where I have suggested, I doubt whether the average man is conscious of this and, if he were conscious, whether it would be worth while for him to state such a general objection.

Objections must find a focal point in order that they can be expressed. It is no use simply to object to the growth of industrialization when it is known that the future of the country depends on this growth. It is no use for the average man to object on technical grounds, because he is likely to be out-argued. Thus it comes about that the main objections come through bodies such as the National Parks Commission and the Conservancy Societies which can speak with some authority; it would be a mistake to imagine that the man in the street is not behind them, though his underlying motives may be far from their stated objections.

The cynically amusing treatment which Compton Mackenzie gives to a similar problem in his *Rockets Galore* is not unreal if one remembers that a lot of amateur ornithologists watch birds not because they like birds but because in their leisure hours they dislike men. If one wished to be cynical about such objection one would remember that the conservancy of nature is probably excluding the public from far more acres of countryside than will ever be covered by nuclear power stations. But such cynicism is not justified if one remembers the basic reason for widespread objection.

The Central Electricity Generating Board by the Act of 1957 is charged not merely with maintaining an efficient and co-ordinated supply of electricity but is charged also with the preservation of amenity. The Board is an industrial body, and in industry a financial yardstick must be used. This financial yardstick cannot be applied rigidly in assessing amenity values, but I believe that it would be wrong not to have that measurement available before reaching a decision on balanced judgement. In considering this it is perhaps helpful to think of a specific case. The Planning Officers of the Generating Board put forward two sites with the proposal that detailed investigation should be carried out on both of them to enable choice of one (as a possible nuclear power station site) to be made. Axiomatically both are comparatively undeveloped sites, both are within reasonable distance of London; to avoid naming them we will call them A and B.

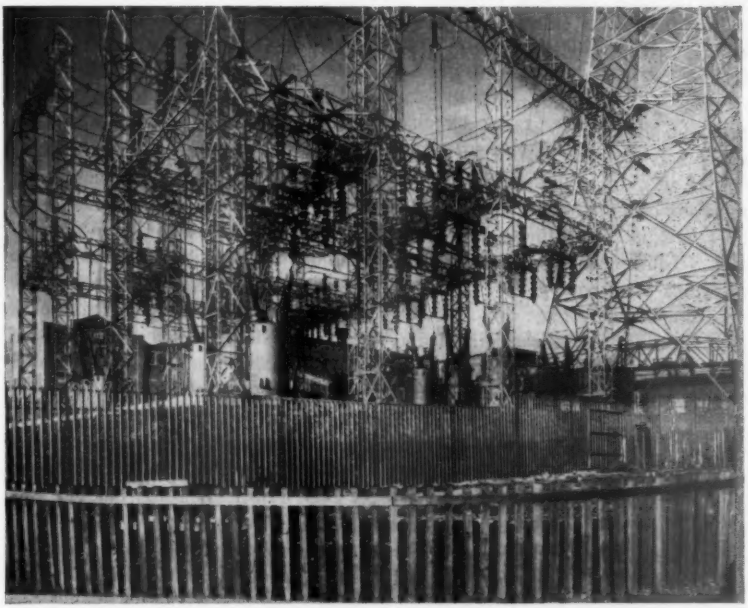
In discussion it was suggested that site B had such amenity value as to make it wrong to do a detailed investigation. Against this it was argued that preliminary investigation suggested that the construction of a nuclear power plant on this site might be £4 million cheaper than construction on site A. Could the Board without investigation reject such a site and decide, without this investigation and without the preparation of firm figures, that it would be wrong to put it forward for Ministerial consideration? Faced with this question, one immediately reminds oneself that if the difference of £4 million is real, this is the amount of money which the public must find to preserve site B. Would a Government be prepared to advance £4 million for the preservation of site B? I doubt it; the

whole of the countryside surrounding this site could be bought for £4 million. Supposing a public appeal were launched to raise £4 million for the preservation of site B, would this sum of money be available by public subscription? Once again I am sure that it would not. If this is the case the Generating Board, which is spending public money, must surely investigate the site and not dismiss the possibility of putting it forward for Ministerial consideration.

But how far can this argument be taken? Hyde Park would be of immense value as a building site, yet no one would dream of suggesting that it should be so used; the financial argument never enters their heads, it is a national asset which is priceless and the thought of putting it to other uses, however remunerative, would be sacrilegious. Hurst Park is also a green area which provides real amenity (of a different sort) for thousands of Londoners, yet the same argument was not used there when alternative uses were under consideration. How does one decide which park should be an analogy for a proposed power station site?

How does one use the financial yardstick in considering the problems of transmission? The cost per mile of a 275 kV double circuit overhead line is £25,000, and this compares with a cost of around £400,000 per mile for underground cables of similar carrying capacity, and there are many technical and engineering problems to be solved before even this can be achieved in practice. In the present state of technological knowledge it appears that undergrounding of transmission would in the long run increase the annual capital investment of the Generating Board by about a half. This would ultimately raise the cost per unit of electricity sold to the Area Boards for retailing by something like 15 to 20 per cent. Would the industrial and domestic consumer be prepared to pay this additional cost in order to avoid the use of overhead transmission lines? Perhaps the domestic consumer would, though I think that the industrial consumer would complain bitterly. But even supposing that consumers as a whole were prepared to pay this additional cost for undergrounding transmission lines, could the additional capital be found? The Central Electricity Generating Board is owned by the people of England and Wales, and they have to supply our capital requirements. They are also the consumers of our product. In these circumstances it is impossible for them to pay the additional cost of undergrounding as it were on the hire purchase system by paying more for their electricity. It is they who have to raise the capital and, in accordance with present practice, this would largely be by Treasury 'Grants in Aid', the funds for which are provided by taxation. I doubt whether this would be welcome. Even supposing it were acceptable, the increased expenditure represents a diversion of materials and manpower from other sectors of the economy and it is probable that this diversion would be undesirable.

I warned you at the outset that I had not been able to find a solution to these problems. In the field of transmission, if my analysis of the true basis of objection is correct, we ought, wherever the alternative exists, to run new transmission lines through country which has already been developed for building or industry rather than through agricultural or undeveloped country. But practical considerations tempt one to do the reverse. We have already seen that most objections



A 132 kV grid connection

to transmission lines are local in their origin and the number of local objections in a developed area is greater than in an agricultural area, and there is the possibility of domestic objection arising from fear of interference with television and wireless reception, and (most importantly) the powers for acquisition of wayleaves over land which is occupied by domestic and business premises are far less extensive than those for agricultural and undeveloped land. As this is determined by Statute and as, in our parliamentary democracy, statutory rulings normally represent the collective wish of the people of the country, it should be concluded that it is preferred that transmission lines should run clear of built-up areas.

It is vain to suggest that more money should be spent on research to bring the cost of underground cable down to the level of overhead transmission lines. This can never be done. The overhead transmission line uses air as an insulator and no insulator can be as cheap as air. Research which is going on may reduce the cost of underground cable but it will always be many times more expensive than overhead lines.

I am sure that we cannot afford to put the main transmission lines underground. The possibility of laying short sections underground where the line would traverse views of abnormal beauty has been considered, but it involves

great technical difficulty, increased possibility of failure and the construction of terminal works at the point of changeover from overhead to underground section which might be more objectionable than the continuous overhead line.

The super grid is at present being operated at a voltage of 275 kV. In Sweden and Russia long-distance transmission lines are being operated at voltages of about 400 kV, and in America experiments are starting on transmission at a voltage of 750 kV. Transmission lines in this country probably face conditions more difficult than those elsewhere in that a greater mileage of our transmission lines is exposed to atmospheres polluted by industry or sea-spray. In spite of this, I believe that we must develop techniques which will enable us to use pressures of around 500 kV for main transmission lines in the future. Lines operating at this voltage could be designed to give approximately four times the carrying capacity of the existing 275 kV lines, and although higher towers would be necessary I believe that the reduction in the number of lines would more than compensate for this. A great deal of research is necessary before such higher voltages can be used, but the solution of the problem is urgent. When the solution has been found it may be possible to replace existing transmission lines by lines working at the higher voltage and so avoid line duplication or adoption of new routes. It may be that in some cases D.C. transmission may be used with techniques similar to those of the cross-Channel cable, but this is bound to be more expensive and is unlikely to provide a solution except in a limited number of special cases. I am therefore forced to the opinion that in the field of transmission, in spite of the priority which is being given to research on the subject, it is unlikely that we shall find any amelioration in less than seven to ten years.

What are the prospects in the power station field that we have also considered? It is, of course, possible to ask ourselves whether the siting conditions which are demanded for nuclear power stations could be relaxed. It would be wrong to assume that the criteria which are at present accepted have been based on firm and accurate calculations. Many calculations have been made, but the allowances which have to be included in these calculations are such that little can be claimed for them except that they suggest that the right sites to use for nuclear power plants are sites similar to Calder Hall. It has already been pointed out that it is difficult to evaluate amenity in terms of money, and it is even more difficult to evaluate amenity in terms of hazard. I do not believe that it is an argument into which it is worth while to enter. In my view we must accept the present criteria until experience is more extensive or until new types of reactor are evolved. It may be that we shall be able to satisfy ourselves that reactors of the A.G.R. type, which are at present being developed by the Atomic Energy Authority and which use ceramic uranium and not metallic uranium as a fuel, can be operated with safety on sites which are less remote than those to which we are led by the present criteria. Let us remember, though, that I have already pointed out that developments of recent years would necessitate the siting of conventional stations outside the industrialized estuaries. The implication is that even if the safety criteria for the location of nuclear power stations is relaxed

the problem would not be removed; we should still be forced to examine sites outside industrialized areas.

It would, of course, be possible to alleviate the problem of nuclear power plant location by installing more reactors on each site, but this would bring with it two disadvantages which, I think, outweigh the advantages. The first of these is that if, from the outset, we set ourselves to build power stations of, say, double the size on each approved nuclear site, the constructional labour force will be considerably increased. Because of their isolated nature, sufficient local labour for construction is seldom available at these sites, and labour camps have to be constructed. If the labour force is increased all of the additional labour has to be encamped. The presence of a large number of temporary workers living in camp conditions in a rural area tends to disrupt the normal way of life in that area and the problem increases rapidly as the number of men increases. The encamped labour force ought to be kept to a minimum, and this argues against an initial size of station greater than that which is at present adopted.

The second disadvantage lies in the fact that if the initial size of the individual nuclear power station is made much bigger, the transmission problem and the conflict of transmission lines with amenity are increased. This is perhaps best understood by a reduction to the absurd; if all electric power could be generated at the point where it is used there would be no transmission problem; if all electric power were generated at a single central point in the country the transmission problem would be at its worst. The practical compromise is to build generating stations of a size which is commensurate with the power demands of the country within a reasonable distance from the generating station. The present practice is to choose nuclear power plant sites which give facilities for expansion at a later date as the local load increases and where labour can conveniently be available.

The fact is that we are not facing a problem which is peculiar to the Electricity Supply Industry. The United Kingdom is supporting a population of 50 million people in an island well designed to accommodate 20 million, and is seeking to achieve a continuous improvement in the material standards of living. This cannot be done without growing industrialization, and growing industrialization demands that areas which hitherto have been rural in their character shall be used for industrial purposes. The Central Electricity Generating Board spends more money each year in industrial construction than any other single organization in the United Kingdom, and it is therefore inevitable that concern about this national problem should be focused on the body which does more construction than anyone else. National problems must ultimately be solved by public opinion, and it is perhaps fortunate that this great and serious national problem finds its focus in an industry which is nationally owned, whose capital is provided directly or indirectly by the people who are tax-payers and voters, and whose proposals for siting are subject to public inquiry held by the Government. I repeat that I cannot see satisfactory solutions to the problems that face us. Perhaps the only way of evolving a balanced policy is through the exposure of proposals to the criticism of public opinion through the medium

of the Ministerial Inquiries which can be held under the terms of the various Electricity Acts, hoping that the criticism will be public spirited and not selfish and remembering all the time that transmission lines and power stations must be built somewhere.

Basically, then, it is possible that the problem cannot be removed. But where construction is necessary it is the part of the architect and the planner to ensure that what is necessary is done in the way which is most acceptable not merely to us but to succeeding generations whose viewpoint will be different from ours. What is the advice that they can give us?

SIR WILLIAM HOLFORD'S PAPER

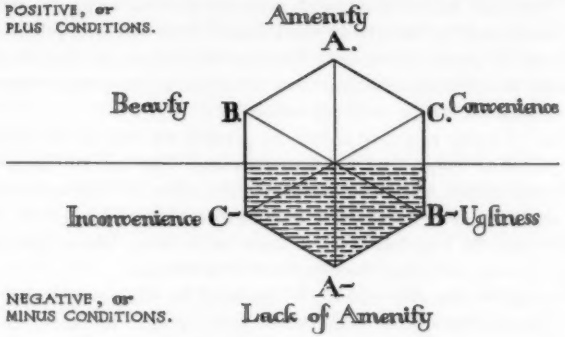
My Chairman has suggested that this problem of preserving amenity, in the face of power plants that have to be constructed and of transmission lines that must somehow or other be threaded through England and Wales, is one which may well turn out to be irremoveable. Therefore it must be faced. One hopes it will be faced with determination and skill, in the light of knowledge gained from other mechanizations that have invaded the countryside in the past, and perhaps with greater sensitivity.

He also asks what advice can be given by those whose jobs are much concerned with the creation and conservation of amenity, that is to say by planning officers and architects and designers of all kinds, and by those concerned with preservation of the countryside.

Let me begin by making the distinction between poachers and gamekeepers. Everything that the architects and the civil engineers design is 'development' in terms of the Town and Country Planning Acts. All development—even demolition—is an intrusion on an established landscape, whether the landscape is natural or man-made. Therefore the architect—and I use this term generically, to cover designers of different kinds—can never be an absolute out-and-out preservationist. The artist in him while striving to create also learns where to destroy; he ceases to preserve as soon as he can design something more interesting.

The true preservationist, on the contrary, can think of nothing better than is there already, probably hallowed by time, or at least by familiarity. Unfortunately, he is often right; and this fact blinds many people to the need to face the challenges of our time, and to make our own contribution to what the next century will, in turn, wish to preserve. Architect and preservationist, although both concerned with amenity, are not interchangeable terms.

The case of the planning officer is somewhat different. Unlike the architect, the engineer and the scientist, he cannot afford to be single-minded. Although he is subject to the discipline of economics and the sway of politics, amenity is his special responsibility; and for him amenity is not a single quality, it is a whole catalogue of values. It includes the beauty that an artist sees and an architect designs for; it is the pleasant and familiar scene that history has evolved; in certain circumstances it is even utility—the right thing in the right place—



shelter, warmth, light, clean air, domestic service . . . and comfort stations. Electricity is therefore an amenity, along with others.

So the planning officer tries to draw a line between all these things that help to create a pleasant environment and those that are regarded as being injurious to amenity. This situation can be very simply illustrated by a hexagonal figure bisected by a line, which shows Amenity, Beauty and Convenience on one side and the anti-amenity conditions on the other

Although the three desirable conditions are all shown, as it were, above the line, it does not mean that there are no differences between them. Each positive value has an equal and opposite discordant value; beauty is contrasted with ugliness, convenience with inconvenience. And these add up in the centre of the figure to Amenity on one side and Lack of Amenity on the other.

But the diagram also indicates what is, in fact, only too evident in practice, that convenience is not far from ugliness, while beauty is just on the other side of the dividing line from inconvenience. This is particularly true of scenery. One of the most convenient places in England for the industrial use and distribution of electricity is in the Thames Valley, east of London; and the scene on A2, near Northfleet Power Station, is one of the ugliest. Here lines of different voltage, different height and different rhythm converge from different directions, and combine with angle towers, switching stations, converters, distribution poles and telephone wires to turn this corner of England into what Mr. W. F. Deedes, M.P., justly described as 'a birdcage'. Conversely, the natural beauty of mountain ranges, moors and waterfalls is usually most striking where it is most inaccessible, most inconvenient for crowds, and absolutely without utilities and comforts; where, in fact, it offers an escape for urban man into the contrast of wild nature that Sir Christopher Hinton has just referred to. This contrast and remoteness may be hankered after subconsciously, or it may be deliberately sought by individuals, such as naturalists or artists. In any case, it is officially and quite rightly championed by the National Parks Commission, for the feelings it engenders are deep-seated and in this country almost universal.

Amenity, however it is described, does not in any case constitute the whole

problem. There are other values, such as rarity, and archæological and scientific interest, which must be entered in the balance. Both of these values strengthen the argument for preservation, as a function of trusteeship; that is to say, the responsibility which this generation owes to its successors to hand over unspoiled as much as possible of the national estate.

The effect of rarity is nearly always to quicken the emotional content of any particular form of beauty and enhance its value. The market in diamonds or French Impressionist paintings illustrates the effect of limitation of supply; and it is probably true to say that Skokholm or Kew Gardens or St. Paul's Cathedral would be less treasured if there were many places just like them. The claim of rarity to special attention cannot be refuted.

Convenience, on the other hand, is increased by mass production. There is no rarity value in the electric lamp or the power plug. The amenities of smoke abatement, of labour without drudgery, and of other improvements in the standard of living, are greater the more general they become. Beside the rarity value appreciated by the few, which can sometimes, because of its exclusiveness, become a snob value, should be set the more common values enjoyed by great numbers of people.

We are approaching a situation now, where the greater part of our land not already built-up has a rarity value, and where every individual site can claim to be in a greater or lesser degree unique: in its history, geography, ecology, architecture, physiography, scientific interest or beauty. This point is argued time after time at public inquiries. The Generating Board, or so it seems to me, can never be dogmatic in resisting this claim. It cannot say that the generation and transmission of electricity is more valuable than the preservation of these singular amenities. At the same time, it knows very well that electricity is basic to the whole existence of this country in the twentieth century, and, therefore, to the preservation of any amenities at all; and as, under the Electricity Act, it has to provide power as efficiently and economically as possible, it stands to reason that efficient and economic sites must be found. Faced then with the objection that nearly every site and every route it needs to use has unique values which it can appreciate but cannot precisely measure, the Board has clearly to consider each case on its merits; and this kind of consideration is bound, I think, to become more and not less important as time goes on.

If the Board cannot discount the 'unique' values of a particular site, still less can it afford to discount its archæological or scientific interest, or its importance for research. Obviously the Board has a duty to minimize this kind of loss; but even programmes of study have no absolute values, and there is generally more than one path to a particular piece of knowledge. The search for economic sources of power is itself a part of the history of science; and the Board should surely have the right to ask for details of the scientific work that is likely to be disturbed and of the evidence that may be obliterated by its own operations. If it is given that information it can do—and I know it would wish to do—a great deal to avoid damage and to further the research that is in hand. I sincerely hope that this will happen increasingly, even under the nuclear cliffs of Dungeness.

This reference to scientific interest and inquiry, although it may seem to be outside my subject, is, in fact, very much part of the amenity problem. It is so frequently linked with rarity value, natural beauty and historic interest that it must be considered as a main factor in any policy of conservation which embraces national parks, nature reserves and the preservation of the countryside.

This introduces a vital argument.

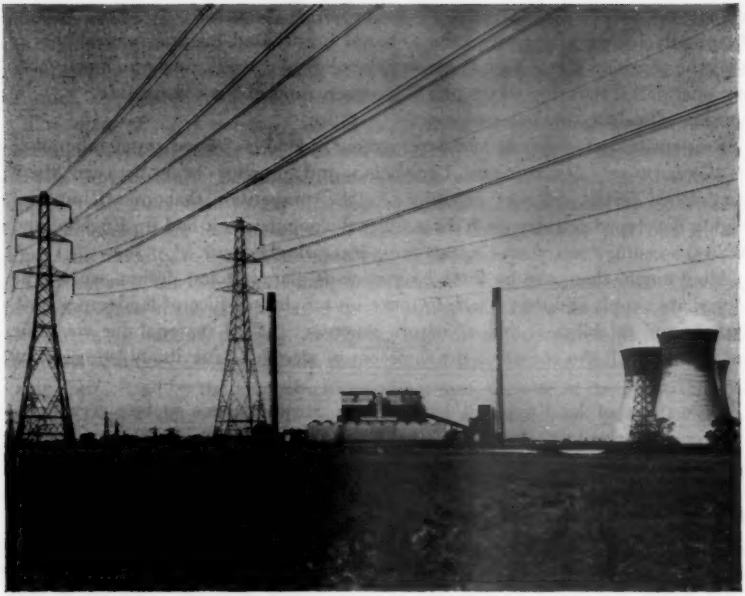
Responsibility for the use and development of land is divided among a number of Government departments. Legislation and practice have between them established certain rules of procedure for the competition that arises; but in a highly developed country, with three times the population it had (in England and Wales) a century ago, such contests must increasingly occur.

How much, then, can be done by conscious planning and design, within the electricity supply industry itself, to make up for the sacrifice of landscapes both remote and established, and of nature reserves, and of material for scientific research, which the economic development of electricity inevitably brings in its train?

In matters of land-use and location, the answer seems to be—very little. As a comparative newcomer to this field, this fact surprised me. With a demand known to be consistently increasing, with a reasonable forecast of the directions from which improvements in generation and transmission are likely to come, and with up-to-date land resource maps at hand, one would have thought it possible for the Board to draw up a realistic twenty-year plan, listing a choice of suitable locations for power stations and lines, and identifying large areas from which they could be regarded as permanently excluded. This would also meet the criticism, so often made, that no place in the British Isles seems to be free from intrusion by the machine.

But the period for which physical plans can reasonably be made turns out to be much shorter than this—more like five to seven years than twenty. Safety, transmission costs, economic and fuel policies and technical development have all combined to make the long-term planning of precise land requirements not only impracticable but deceptive. In an industry advancing so fast, both in technology and size, even the best of long-term plans becomes subject to changes which prevent anticipation in detail. For example, in 1950 a place like Hinkley Point would have been thought quite impracticable as a power station site because it lacked the essential port or rail facilities for handling large quantities of coal. The advent of nuclear power abolished this particular requirement and introduced others which Hinkley Point meets successfully. No plan of ten years ago could have foreseen this or the routes of new transmission lines for the distribution of the power.

If undertakings had been given on the basis of early forecasts and prophecies, their subsequent breakdown would only have brought the industry into disrepute. I do not mean to imply that *no* planning is done. The essence of the nuclear programme is that it is long-term; and this involves planning of a high order. So does the changeover from a single to a multi-fuel economy. But the very fact that demand, supply and investment have to be most carefully matched



Willington power station

makes it *less* possible to plan exactly and unalterably on the ground, for more than a short period ahead, the routes and locations of plant and power lines. This is a case where economic planning, if it is to be realistic and dependable, requires some flexibility in the territorial planning which is a part of it. In a period of more gradual evolution, planning should be able to push further ahead; and this is certainly a desirable state of affairs. Meanwhile, in spite of this disability, there are some compensating factors.

One is that in common with all other forms of development in these islands, the amount of new ground which can be broken is limited and is becoming harder and harder to acquire.

The picture is sometimes conjured up of a countryside littered with industrial ruins—not only disused but dangerous. But as already happens in urban areas in the case of offices and houses, and increasingly for extractive industries in the countryside such as iron ore, sites have to be redeveloped or reclaimed to a far greater extent than they used to be, even when it costs more to do this than to open up virgin land. The electricity supply industry may, for instance, be able to reclaim some 132 kV (and smaller) transmission lines, if the super grid can replace them on the same routes, and if the smaller lines are not still required for local distribution.

Another view of Willington power station: the cooling towers seen from across the river

Moreover, the big new station sites on estuaries and on the coast have been chosen for the very reason that they can be developed and redeveloped for generating purposes to maximum capacity, and will not be subject to early abandonment for technical reasons, such as an increased demand for cooling water, or lack of expansion space.

A second compensation is improvement in the technique of selection, as applied to places and objects that ought in the national interest to be preserved as part of our cultural heritage, even at considerable cost.

A comparable instance is the preservation of historic buildings. Two different types of working committee exist, responsible to Ministers and backed by a considerable number of voluntary associations and trusts. One is the Advisory Committee to the Minister of Housing and Local Government, who has a duty under the Planning Act of 1947 to make lists of all buildings of *special historic and architectural interest*, and to persuade owners and local authorities to preserve them. The other is the Historic Buildings Council for England which (with its counterparts in Wales and Scotland) was set up under the Act of 1953. Its function is to recommend to the Minister of Works the really *outstanding* examples of historic buildings for a grant in aid of preservation, when private resources are unequal to the task.

These committees, by research and practice, and by the pooling of their knowledge and experience, have succeeded in establishing two sets of criteria for preservation, the one a criterion of special interest (mainly informative and educative), which is widely applied and sub-divided into categories, and the other a criterion of outstanding importance, resulting in a highly selective list of buildings eligible for grant.

Now it is true that all selections are imperfect, and that taste and judgement vary with time. Nevertheless the results of these exercises are effective, in that the risk of wanton or unrecognized destruction of things of great value is reduced to smaller proportions. Moreover, they provide time and the opportunity for public interest and support to make itself felt. Most important of all, an approximate but usable scale of values is established, on which economic and policy decisions can be based. These decisions have sometimes to be taken urgently.

No comparable scale of values exists for scenery or for visual amenities generally. This is natural, since value judgements would play an even larger part than in the selection of historic buildings and, as I tried to show, the criteria would have to be many-sided and therefore less exact. The National Parks Commission's *Areas of Outstanding Natural Beauty* will include, in addition to the National Parks themselves, a high proportion of the total area of what we call 'countryside'. And rightly so. But the selection is too broad to provide a basis for the total exclusion of overhead lines. In 'green belts', for example, the main object is to exclude the random spread and scatter of buildings. The greater compactness of urban development inside and outside these belts will need to be served—and itself assisted—by electricity. In fact, when the London Green Belt Act was passed in 1938, the procedure for obtaining clearance for overhead lines was specifically included.

So that in this respect the present classifications do not go far enough. The same is true of a number of other land reservations. To paraphrase George Orwell—they are all entitled to respect but some are entitled to more respect than others.

The irony is that the cost of undergrounding one single mile of 275 kV cable is about equal for example to the sum voted annually by Parliament for assistance in the preservation of all the historic buildings of England and Wales.

A great deal of skill and care is given by the Ministry of Works and its advisers to this kind of building preservation, and the money comes from taxation. If the great British Public could be directly consulted as to whether they would rather spend twice the present amount on saving historic houses, or on undergrounding a vital mile of overhead cable, they might conceivably vote for neither and choose instead a fractional reduction in taxation.

The Board, however, is spending its consumers' money, and is continually kept aware by Parliament that these consumers are the same great British Public. Its responsibilities are, therefore, if not conflicting, at least double-edged.

So it seems all the more necessary that the Board, when interpreting its responsibilities for the preservation of amenity (under Section 37 of the Electricity Act of 1957), should have the advantage of any technique that can be devised

Staythorpe power station

towards the establishment of a scale of values, however imperfect it may be at the start. The almost astronomical cost of undergrounding sections of a high voltage line makes it imperative that, if it were ever contemplated, it would be only at places where the visual amenities are in the highest category.

A third compensating factor is the positive contribution that can be made by good design, using the term in all its architectural, engineering and landscape senses.

First of all, let me say that I agree entirely with my Chairman when he suggests that where the dislike of all structural manifestations of electricity is due to a strong psychological resistance to the invasion of nature by the industrial machine, then good design by itself will not lessen it. The man-made structure, however magnificent, and the transmission line, even when it adds perspective to a flat landscape, will still be causes of offence. But it is quite a different thing to say that design does not matter. There is a 'Shoot-the-Pianist' school of criticism which holds that the objects themselves are hideous and inhuman, that no one should pretend that they can be made to conform to the humanist principles of architectural and landscape design, and that the only solution is to bury all turbines and reactors, all switchgear and cables, underground.

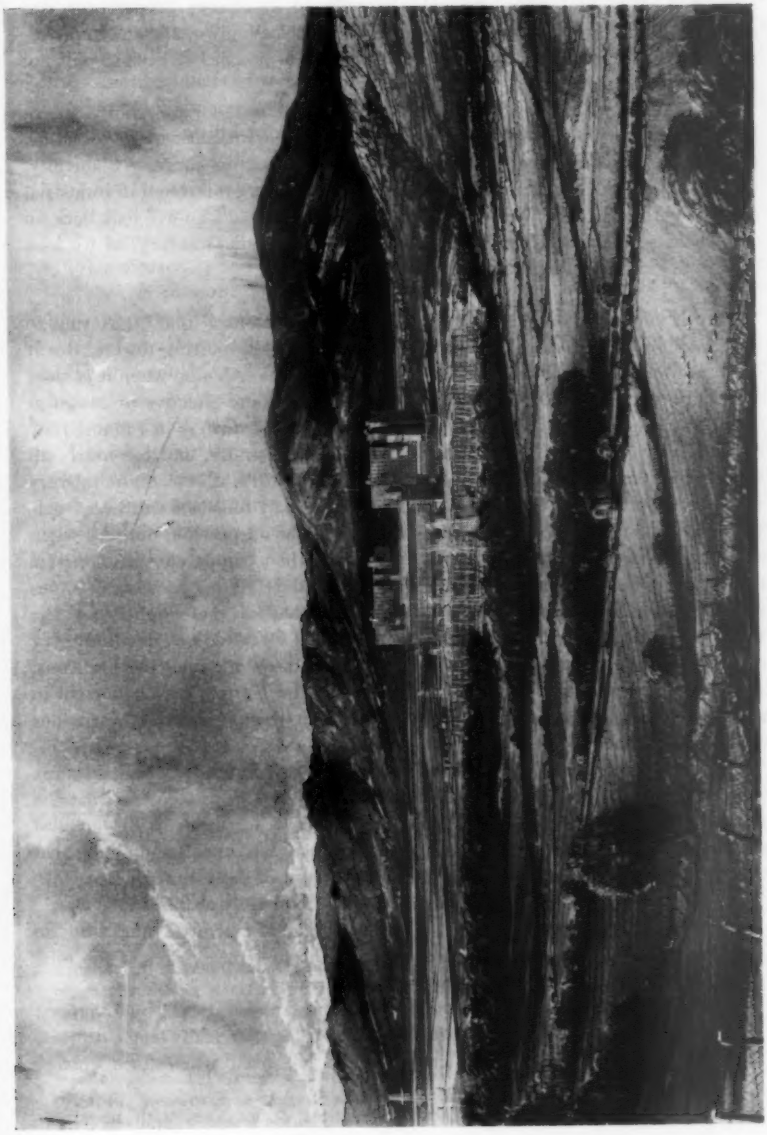
I think this attitude could be disastrous. If the Generating Board were to

accept it, I should resign at once. It would lower the standard of appearance of all new development, without any compensation in the shape of masterpieces of our own age to set beside those of the past. Dr. Johnson objected to canals, and had some right to do so; but the sheer technical challenge, combined with a strong sense of aesthetic responsibility, eventually produced structures like Telford's *Pont Cysyllte Aqueduct*. Wordsworth and half the landowners of Britain objected to railways as an intrusion into the countryside; and Oxford and Bangor can show how poor visual results can be when there is no sympathy for the work on either side. Yet the course of the old Great Western Line, and structures such as the Albert Bridge, Saltash, Wharncliffe Viaduct, and Bristol Station, remain as superb designs. On Boxing Day 1835, Brunel wrote in his diary: 'I am thus engineer to the finest work in England'. If Brunel and his contemporaries had been brought to believe that design did not matter, we should have kept the worst and lost the best that the railway age had to offer.

Genius cannot be hired; but standards can be set, and subsequently raised to the level of excellence. The Board now seeks the advice of the best landscape architects they can find, for an appreciation of the amenity problems raised by the location of plant in different kinds of landscape. The designs for new stations, both nuclear and conventional, are being undertaken by some of our foremost architects; and within the limits imposed by science and technics, and prior commitments on certain items of plant, a great deal of imagination and skill is being directed towards improvement in the comprehensive design of power stations. There is a very long way to go, particularly with such problems as cooling towers and the way they are massed in relation to the main station buildings, with cladding materials, sub-stations, and even fencing; but at least these are being recognized as design problems, in the solution of which not only the Board's engineers and architects, but also the Building Research Station and the Council of Industrial Design are engaged.

As in other fields of design, standards of performance are fundamental rather than the standardization of materials and patterns. To establish a design tradition two procedures are necessary. The first is the identification of the problems at headquarters, and the preliminary thinking that leads to experiments, programmes and precise terms of reference. The second and more important process is application in practice and in the field. Those of you who remember the school-building programme that resulted from the war and the Education Act of 1944, will have noticed how the cost per place was consistently reduced while the designs of the schools themselves were very generally improved. The central design team in the Ministry of Education established the standards of performance and cost, but the improvements, in all their regional and local variety, resulted from their application by education authorities outside, working in friendly competition.

This illustration, although it applies to development on a smaller scale, has a close bearing on the number of nuclear power stations built in the next few years. I am not competent to argue the case from the point of view of investment or fuel policy. I can only offer my opinion, as a designer, that if development is



Artist's impression of Trawsfynydd nuclear power station

limited to research, and stops short of construction—as a number of critics have suggested—then unit costs can only be reduced in *theory*; because the real standards of performance and maintenance will not be known, and the improvements born of experience in the actual execution of a series of designs will not have been made.

My contention, in short, is that effective design can do something, not to lessen the impact of industrialization on those who want most of all to escape from it, but to compensate in some degree by offering an alternative amenity. It is an amenity that will appeal at once to those who are interested in industrial design—particularly the young—and also perhaps to those who will look back on our whole performance from the vantage point of another century, as we look back at the railway builders of a hundred years ago.

Even if you agree on this general point, you may think it quite irrelevant to the problem of overhead transmission lines and their supporting towers. But it is not entirely so. The tower itself—even for the 275kV circuits, when it is close on a hundred and forty feet high—is about as simple and effective in design as it can be. I have compared it with the designs of similar towers in France, Italy and Germany, and in Canada, South Africa and Australia; and for nearly all the types of landscape in which it is used in this country, it is to my mind very much to be preferred. Uncoloured and with the matt finish of weathered galvanizing, the steel lattice is the least conspicuous of all possible outlines when seen against sky or hill. This is particularly so when compared with concrete towers, even though these might be cheaper to produce. When painting becomes necessary, my own preference coincides with that of the Council for the Preservation of Rural England and others, namely for a light or medium grey or grey-green, depending on the type of country through which the line runs. Apple green, light blue and white, which have all been tried, may look right in a few situations, but not in this country with its ever-changing seasonal variations of natural colour.

But it is idle to pretend that their tall heads can be hidden, or their insulators camouflaged, in any landscape, however carefully they are placed. All that the wayleave officers can do is to mitigate the effects of intrusion to the greatest possible extent. Judging by what I have seen of their activities, I should say that this is precisely what they set out to do, in every part of the country.

As I see them, the basic rules to keep in mind are broadly as follows:

(1) avoid altogether the major areas of highest amenity value, by so planning the general route of the line in the first place, even if the total mileage is somewhat increased in consequence;

(2) avoid smaller areas of high amenity value, or scientific interest, by deviation; provided that this can be done without using too many angle towers, i.e., the more massive structures which are used when lines change direction;

(3) other things being equal, choose the most direct line, with no sharp changes of direction and thus with fewer angle towers;

(4) choose tree and hill backgrounds in preference to sky backgrounds wherever possible; and when the line has to cross a ridge, secure this opaque background as long as possible and cross obliquely when a dip in the ridge provides an opportunity. Where it does not, cross directly, preferably between belts of trees;

(5) prefer moderately open valleys with woods, where the apparent height of towers will be reduced, and views of the line will be broken by trees;

(6) in country which is flat and sparsely planted, keep the high voltage lines as far as possible independent of smaller lines, converging routes, distribution poles, and other masts, wires and cables, so as to avoid a concatenation or 'wirescape';

(7) approach urban areas through industrial zones, where these exist; and when pleasant residential and recreational land intervenes between the approach line and the sub-station, go carefully into the comparative costs of undergrounding, for lines other than those of the highest voltage.

To this rough guide, which can never become a formula because each line has to be considered in great detail and on its merits, I should like to add, finally, a preference of my own.

I think it is more worth while to clean up a large number of small untidy areas, where many people are aware of the clutter surrounding them, and therefore adopt the attitude—'Nobody else cares what our place looks like, so why should I'—than to attempt undergrounding of the high voltage lines. These, although they intrude on natural scenery, do so with a certain dignity. The smaller lines could sometimes be undergrounded with advantage.

The adoption of such a principle would be costly, for Generating Board and Area Boards alike; but on the score of amenity, at least, it is a cost that could be amply justified.

DISCUSSION

MR. E. M. NICHOLSON, C.B.: I should like to speak personally, and not for the Nature Conservancy on this occasion. I welcome, as I am sure we all do, the very high level of the discussion which has been set by Sir Christopher and Sir William. We are all wanting more power and also wanting amenities. We have split personalities; we want to have it both ways and we are very distressed when we find that we cannot. The first thing I want to say is that we should not go in for wishful thinking. We should not pretend there is not a bill to pay and we should not deceive ourselves as to the size of that bill. The whole of this subject takes on quite a different complexion if one looks on the balance of advantage over, say, fifty or a hundred years as compared with the balance over, say, five or ten years.

Sir Christopher mentioned *Rockets Galore*; well, that book was written against me because I negotiated an agreement with the Defence Departments for the protection of the St. Kilda wren and other birds which Compton Mackenzie said compared favourably with the protection negotiated by colleagues in other departments for the human beings who were threatened with eviction! That was an occasion where at one and the same time three sites of the utmost national importance in the Hebrides were threatened. Before the scheme could be started the whole technical background changed; before the scheme could be carried out, one of the sites, unfortunately the least important from our point of view, was dropped entirely, and the whole life of that project is obviously limited to a few years.

These great toys which are so expensive continually change their shape, the technical conditions change, and with the best will in the world those in charge of them cannot even see ten years ahead. We have got to remember that the nation is balancing something really vital and everlasting in the national life against something which is inherently ephemeral but yet causes permanent and irrevocable loss of scientific values and of amenities. My first point then is about trusteeship. Have we really begun to consider what that word trusteeship means—what message are we going to send to posterity? Posterity will not judge by what we say, but by what we do, and the message which we are now sending down to posterity is the very well known one, 'I'm all right, Jack'.

May I make one suggestion which I believe to be constructive? It arises out of what Sir Christopher and Sir William have both said: we list and preserve historic buildings, we locate and preserve sites of scientific interest on the biological side, we make an assessment of loss of agricultural land, but we do not have any sort of national Domesday Book showing what are the really priceless regions and sites of all kinds in this country. Has not the time come when we should have such an assessment, so that we could put into some sort of order what should be the really untouchable sites, those which must at any cost be handed down to posterity intact and unspoiled? Sir Christopher said that no one would dream of interfering with Hyde Park—well some suggestion for exploiting Hyde Park is put forward almost every week, and the reason why it stays unspoilt is because people damn well see that it stays so!

I now wish to touch on the economics of the matter. All these figures we are given depend entirely on arbitrary decisions about, for instance, the way in which loans are made available at certain arbitrary rates of interest; they do not correspond to long-term economic costs, and one great industry which is left very much out of the calculations is the tourist industry. The tourist industry is earning in foreign currency as much as the steel industry, and the places where the tourist industry makes that money are very limited and can actually be pin-pointed. In Devon and Cornwall, for instance, they made in a recent year fifteen million pounds in foreign exchange. It would take some refinement of economics to do this pin-pointing, but we must remember that there is an economic loss if anything reduces an amenity which has a growing earning power. It is quite possible (indeed it has happened) to do something in the name of economics which actually inflicts a net loss on the gross national product. It is high time, I think, that economics got down to quantifying that.

Sir Christopher explained that some research is at last being done on transmission. I am wondering whether if more research on transmission had been done earlier a great many of these problems of the transmision lines would not have been solved? I am a great believer in research. The fact that we have a nuclear power programme at all is an advertisement for research, and I believe that more research on transmission and on various aspects of construction would have produced results. Never, for example, have I seen a scheme for a power station which provides sufficiently against its indirect harmful effects—its effects on water; the effects of tracked vehicles running all over the place and messing up areas right outside those shown on the maps submitted at public inquiries. The whole question of building these stations so as to create less disturbance during the five or seven years of the construction period is one on which there should also be research.

MR. W. B. YAPP (National Parks Commission): I should like to make three points, each of them leading up to a question. The first is that I really could not follow Sir William when he said that the engineers cannot plan twenty years ahead. He said that in 1950 we could not foresee the necessity for having power stations on isolated sites like Hinkley Point. Well, I remember Lord Rutherford discussing the energy locked up in the atomic nucleus in 1926 and saying that it would undoubtedly be

liberated sometime and implying that the site of the operation would have to be a long way from centres of population. The whole of this electric programme really depends on three inventions only; the dynamo, the steam turbine and the splitting of the atomic nucleus, all of it pretty ancient stuff. What seems to me to be happening is that the technical people are not getting across to the general public what it is they are thinking of. As you know, Sir, we have lately had referred to the Parks Commission two cases of applications for short lengths of 275 kV line. Now I think I am right in saying—I have talked about this to engineers—that to suggest putting up thirty miles of 275 kV line not connected to any other 275 kV line just does not make sense. But we are told that plans are not definite: 'We do not know whether they will be connected', and so on. It is obvious that all nuclear power stations will be connected up by 275 kV lines sooner or later. If a station is put in the Isle of Wight it is going to be connected to the ones in the Bristol Channel, and so on. There must be a long-term plan for that which is not divulged, and I think it would help the planners if we did know in advance as much as the technical people are thinking of. My first question, then, is why cannot we have advance information even of tentative plans?

My second point is tied up with Sir Christopher's point—this matter of research on transmission. I read a very interesting book a little while ago on the history of the electric cable, and it showed that the generating engineers are ahead of the cable manufacturers the whole time. When the old London Electricity Company proposed to supply power at 2,000 volts they were told it was impossible to put it underground. So we go on. We are now told that 275 kV can hardly go underground—it needs more research—but the generating people are talking about 400–750 kV now. We want to step up the research on transmission to keep in line with the research on generation, and I think (like Sir Christopher, though on rather different grounds) that the economics put forward here are a bit phoney—and this leads to my second question. Would undergrounding not in fact be very much cheaper if more lines were put underground? So long as you never give the cable companies an order for more than a few hundred yards of cable, of course it will be expensive; but I am reasonably certain that if only the cable was ordered in large lengths it would be much cheaper. I accept the fact that it would be more expensive to put lines underground than above, but I do not accept the arithmetic which simply multiplies the cost of short lengths.

My third point is, can we not have more thought devoted to the designs of the smaller things, the insulators, for example? I have a suspicion that they are simply bought from the glass-makers because they are efficient, and no effort is applied to improving their design. Can they not be made from a glass of different colour, or from some other material, so that they are not so conspicuous?

SIR CHRISTOPHER HINTON: I should like to start by disagreeing on one point. Only two years before he died, Lord Rutherford said that he could see no prospect whatever of nuclear fission being used industrially. I agree that with thought it was possible at the end of the war to predict that nuclear power was bound to come and bound to start replacing conventional fuel, I do not believe that anybody could have foreseen the date, because the date was in fact determined by cold-war conditions which ensured that vast quantities of money were put into defence research. It was through defence research that work on nuclear power was brought quickly to the point where industrial application was possible. I do not think anybody could have accurately forecast the timing.

I wish we could see farther ahead, and we are struggling to do it all the time. We are seeking to meet demands by Area Boards who retail to ultimate consumers. The Area Boards cannot exactly predict industrial demand in particular areas, even for three years; they can guess five years ahead, but beyond that they cannot go.

In order to keep the transmission problem to a minimum, we must locate our generating plants as near as possible to the points of consumption. Without long-term knowledge of location of demand it is difficult to plan power station location even five years ahead, and it takes four years to build a station. Moreover we can only build the stations and the transmission lines with ministerial consent. Let me take a specific case: the transmission line at present being planned to run from Dungeness across East Sussex is routed up to a point where it finishes with a connection to the 132 kV network. We know that it has got to go beyond there but we do not know exactly where. We are investigating power station sites near Chichester and on the Isle of Wight; we do not know whether we shall get ministerial consent for either of those sites. If we do not get a consent for either, that transmission line should be extended towards the North-West to join the outer London ring. If, on the other hand, we get consent for one or other of those sites, the line ought to extend west. We do not know and we cannot yet know the route for the extension. Little as I like this indecision, it is a position that we have to accept; all the time we are striving to push the frontier of our planning farther forward. I think that we shall push it out a little, but there is a limit beyond which we cannot push it.

You said next that it seemed to you that the generation engineer has always been ahead of the transmission engineer, and I think I must agree. The insulation of cables to-day is still the oil-insulated paper that was invented by Ferranti about 1880, but let us face the fact that there is always bound to be a wide disparity between the cost of overhead transmission and underground transmission. In the first place, overhead cable uses air, which is free, as an insulator; secondly, the electrical insulation of the underground cable also provides thermal insulation, and therefore the current density in the conductor must be smaller to avoid overheating. The disparity in cost will narrow with the passage of time; it will always, I think, remain great.

You spoke also about the design of insulators, and once again I agree with you. I think that we ought, from the amenity point of view as well as from the technical point of view, to consider where ceramic insulators ought to be used and where glass insulators should be used. The idea of coloured glass is one that we could explore. We are also looking at the possibility of a completely different insulating system, where for instance we rely on a non-conducting branch arm instead of a suspended insulator; this would enable us to shorten the tower. Research is being pushed ahead energetically.

MRS. JOHN DOWER, O.B.E., J.P. (Deputy Chairman, National Parks Commission): Sir Christopher has given us very good reasons against the undergrounding of 275 kV lines, but in the countryside it is the undergrounding of the much lower voltage line which is of more immediate concern. The Area Boards, whose concern it is, very often are not ready to underground to anything like the extent that the National Parks Commission or the Park Planning Authority or the C.P.R.E., or whoever are concerned with it, would really desire, because the Area Boards use the financial and not the amenity yardstick. Whatever money we use for undergrounding for landscape purposes—whether it is government money, or whether the Area Boards themselves supply it or whether it is from the individual consumer—it is all from the community. Would it not be possible to persuade the Area Boards to take into account this aspect as the financial hazard in their public service, just as the Central Authority is ready to spend quite a good deal on advice and on the landscaping of nuclear stations? So very little a sum added to the cost of electricity to the consumer would give a sum large enough to cover all the undergrounding needed to make a very great difference to the landscape of our countryside.

SIR WILLIAM HOLFORD: As I am only a part-time member of the wholesaling organization it is perhaps more appropriate that I should answer Mrs. Dower's very pertinent point about the retailers. Like all retailers, they are obviously keeping

an eye on the cost of the product to their customers, and so it is quite natural that they use the financial yardstick and not the amenity yardstick. If I may speak not as a member of the Board at all, but as an architect, I could not agree more with Mrs. Dower about this point, because it bears on what I said in my paper: that it is more worth while to tackle the clutter which is caused by the small lines, than it is to tackle the very much more costly undergrounding of the big lines. But the wholesaler cannot go to his retailers and say, 'Now you must put a little more cost on your product in order to meet the amenity point of view.' This is one of the most interesting items thrown up by to-day's discussion, and I should like to hear more about how the meeting considers the retailer's problem is to be met. I am sure that it should be met, but I know Mrs. Dower will sympathize with me when I say that the Generating Board cannot say to its retailers, 'You have got to charge more for current.' They are always pressing the Board to keep their charge as low as possible in order to meet amenity costs among others; and although I feel as an individual that that is precisely what should be done, you will see why I am leaving my Chairman out of this argument.

MR. PHILIP BARNES (Secretary, Lancashire Branch, C.P.R.E.): I have come right from the front line of this particular battle. We are faced with many overhead electricity lines, from small local distribution schemes to major super-grid schemes, and I want just to say something about the local schemes.

If we could feel there was a policy going from the top right down to the local officials with whom we deal on these matters, a policy of readiness to spend money where it is really necessary, to spend it in order to save beauty, we should feel more satisfied. But what happens in fact? Only last July I got an application referred to the Branch from one of the Divisional Planning Officers in Lancashire affecting an attractive little village in the middle of the Lancashire green belt, a completely rural village of farms and cottages. At present there is a medium voltage line running down the village street, three wires under one another. The electricity people want to reinforce the supply, presumably because more and more electricity is being used; they propose to put the three high voltage lines on the same poles above the medium voltage lines, so that the disfigurement of the village is going to be increased. The County Council, the Borough Council, the C.P.R.E. and the landowner all think that the new lines should go underground and the old lines should go underground too, but in a letter dated 27th July to the County Council the Electricity Board say this: 'The most satisfactory solution so far as your committee is concerned would be for an underground system to be provided between points A and B. The additional cost to the Board for this work will be approximately £2,500, and we shall be pleased to hear if the Lancashire County Council together with the Crosby Borough Council and other societies interested in this village will pay for this additional expenditure.' That does not go down well when we hear a few months later that the Electricity Authority made a surplus in one year of twenty-seven million pounds.

There should be some evidence, from the top right down to the local bodies, of willingness to spend money when everybody—the planning people, the C.P.R.E. and the local people—thinks that money should be spent.

Then we come to the much more difficult problem of super-grid lines. In several years experience of this work I have never described a super-grid pylon by itself as ugly: individually it may be a graceful thing. But, again, what do we find in practice? We find that a super-grid line is nearly always routed alongside a 132 kV line, sometimes alongside two 132 kV lines, all of different design, of different heights, of different spans. I can think of one unfortunate spot a few miles south of Lancaster, a valley which ten years ago was very beautiful indeed, where at one point there are now forty towers or pylons around the individual as he stands on the public road, and over twenty cables across the road! Well, that maybe the landscape of power, but it

shows no respect for the beauty of England, and such a disgraceful example of disfigurement has been repeated time and time again in the county that I come here to represent. It may, under certain circumstances, be wise to follow an existing route and avoid bringing a new route across country, but it certainly is not wise everywhere to do this where the scenery is good. The effect of two lines is far more than twice as bad as one line, and if you want proof of that go up the Shap Road to Scotland. That in my opinion is a disaster: there are pylons everywhere on one of the finest moorland roads in the whole of Britain. Nearly a hundred years ago William Morris said, 'The world which was beautiful before man came upon it, which for hundreds of years increased in Beauty as men did in power and numbers, is now growing uglier day by day and there the swiftest where civilization is the mightiest. This is the truth; no one can deny it. Are you content that it should be so?' The only difference now, a hundred years later, is that the process of disfigurement is so much quicker, so much more widespread.

SIR CHRISTOPHER HINTON: Sir William said just now that the Area Board lines are not my concern, and I do ask you to remember this; I cannot talk about the low tension lines—they are run by concerns which are legally and financially completely independent of mine. What I should like to talk about is the question of main transmission lines running side by side.

I think that it is objectionable to have lines of different rhythms running in this way; but if a new line is being constructed, a lot of planning officers ask our wayleave officers to keep it alongside an existing line. It is difficult to generalize; I believe that there are some cases where it is best to keep lines together, particularly in the industrial fringes of towns. I think there are a great many places, particularly in open country, where it is better to keep them apart even though it may mean having a second line in a part of the country which did not have one before. This is a thing that the wayleave officers are conscious of, and one to which they give a tremendous amount of thought; I leave you to imagine their difficulty when they are putting a line across country and find that one county planning officer likes the lines kept apart and the planning officer in the next county wants them kept together.

William Morris was right up to a point, but we live in a man-made country, and so far as I am concerned there is nothing so depressing as an abandoned countryside like parts of the Western Highlands, where villages are deserted and roofs torn off the crofts because no industry has retained the population.

MR. J. R. JAMES (Ministry of Housing and Local Government): The phrase 'financial yardstick' has been used, but the difficulty is that we have no financial yardstick. There are no scales on which we can set the continuing advantages of beauty in the countryside against the extra immediate cost to the C.E.G.B. It is this which bothers the public, who have been led to believe that the value of the unspoilt beauty of the National Parks is irreplaceable. They assume that if, for example, Snowdonia had not existed, the extra electrical power required by the Lancashire towns and industries could have come from a new power station on the Trent, using air cooling if the river flow was inadequate for water cooling. It would cost more, but how much more? It is this type of cost problem, not the difference in costs between alternative sites three or four miles apart, which needs to be more fully discussed.

The other thing is that the extra price to be paid should reflect public opinion. But in how many cases have the responsible authority spent so much money to achieve a certain amenity objective that the public has resented it? When the public feels it has been overcharged we shall begin to get a test of the strength of its opinion. At the moment it seems that we have only a measure of how much the Board will stand, or the Minister.

SIR CHRISTOPHER HINTON: On the question of the financial yardstick, I should say

that I have a guilty feeling that the Board is sometimes prepared to spend more than could be justified by comparison with expenditure in other fields of amenity.

SIR WILLIAM HOLFORD: May I add to that? Can I deal with the money question first? Mr. James really suggested that the public know how to value money paid out on amenity matters better than the Board, the Minister or presumably Parliament. The difficulty is that the whole basis of judgement can never be put to them. If you are valuing a business operation, you can expect the capital accounts committee or any other committee, or a group of accountants, to tell you that you are wasting money or that you are not trading economically. That is capable of proof. But the kind of proof needed where, for instance, we put an underground line through the suburbs of Bournemouth—cannot possibly be put to the public in, so to speak, 'amenity' terms. I do not think this is a real question, but I think what is certainly real is Mr. Nicholson's point of irrevocability; namely that what has to be done in the establishment of a large nuclear power station is irrevocable, and so is the loss which it occasions in many directions—in scientific research, in amenity, in beauty.

To that I really do not know what one can say except to adopt Mr. Nicholson's suggestion for a kind of scientific/aesthetical Domesday Book; otherwise how is one to judge what the loss, that irrevocable loss, is really worth? After all, we have had years of industrial development, we have had roads and railways. The same thing can be said about Telford's Road, the A5, as was said about many of the railways, namely that if they went through certain scenery the loss was irrevocable, the ruin was final, and therefore it could not be measured against any sums which the railway company were likely to put up in the form of compensation. I do not think there is an answer to that, except the one which Mr. Nicholson suggested, that we should seriously attempt to record (as we already do in the case of buildings) what are the unique things, the things really valuable to us. I should very much like to see that done.

LADY SAYER: I come from Dartmoor. Sir Christopher said that undergrounding was 'not acceptable'—not acceptable to whom? A debate in the House of Commons the other day was very reassuring to some of us, because if Members of Parliament are in fact our representatives, then they are making it very clear that they and we are willing to pay more for undergrounding lines. I do not accept the sum of 5*d.* on the income tax for undergrounding all transmission lines, and I do not accept that anybody is asking for all transmission lines to be put underground. What we are asking for is that in places of very great natural beauty (and of not-so-very-great natural beauty), real consideration should be given to the undergrounding of lines. Now it has been said—Sir Christopher will correct me if I am wrong—that if, out of that twenty-seven million pound surplus, one and a half million pounds were granted by the Central Electricity Generating Board to the Area Boards as compensation for 'undergrounding' in beautiful areas, then six hundred miles a year could be undergrounded in the national parks; that is at the rate of about sixty miles a year per national park. Speaking as one who lives in a national park very much disfigured by overhead lines, I should say that that would solve our problem. And it would only cost the consumer, I understand, about $\frac{1}{10}$th of a penny per unit added to the present cost. It is a very bold man who is going to say that we are not willing to pay that! We are. I always query this claim of something being 'unacceptable'. Who said so?—it is always some distant mandarin, and not the people themselves.

SIR CHRISTOPHER HINTON: You say that only some of the transmission lines need undergrounding, but in my experience each individual who claims this gives priority to his own district. You are interested in the lines on Dartmoor.

LADY SAYER: Not only in lines on Dartmoor.

SIR CHRISTOPHER HINTON: There are other people who are equally interested in

lines in the Midlands, in Lancashire, in Kent, and in North Wales. One has to accept the fact that it is a national problem. I agree that we have got to consider undergrounding short lengths of line in areas of outstanding beauty, but this is not an easy problem, because at the transition point from the overhead to the underground there must be terminal works which would often be more noticeable than a continuous run of overhead line.

The suggestion that the Generating Board should give a subsidy to the Area Boards so that they can underground distribution lines is not really practicable. The finances of the electricity industry are run rather like a co-operative society, and apart from a small margin we charge the Area Boards what it costs us to generate and transmit to them; so there would be no advantage to them in our giving a subsidy, since it would increase the price they have to pay. You say that the consumer is prepared to pay a little more to have the lines across Dartmoor put underground. If the Area Board got this extra money they would ask themselves if this is the best use to which it could be put. In your area rural electrification has not gone as far as in some other areas, and I am certain that if you went to your Area Board and offered extra money they would feel inclined to say that the first call on this money should be electrification of farms which have no electricity supply.

MR. DAVID BIART (Chichester Civic Society): I come straight from the front line, situated as we are close to two sites which are now being investigated by the Central Electricity Generating Board. This would not, of course, be the appropriate place to go into all the objections that many have to nuclear generating stations, but I should not like Sir Christopher Hinton to leave the meeting without knowing the increasing anxiety about, and objection there is to, these stations, not only in the Solent area but in the country generally. My question is this: we have heard reports that the nuclear power stations only last for a matter of some twenty years (these reports emanated from the inquiry at Trawsfynydd). Thereafter they have to be sealed off and one is left with enormous radio-active piles desecrating the countryside. Now, Sir, are we in fact mortgating our heritage for such a purely transient advantage?

SIR CHRISTOPHER HINTON: Nuclear power stations at the moment are being written off financially in twenty years; whether they will last twenty years or thirty years or thirty-five years (which is the life of a conventional power station) there is not enough experience as yet to say. When their time expires all the buildings will be demolished, but the biological shield round the reactor core will not. This, in relation to the overall size of the station, is small. The sites on which these nuclear stations are being built are difficult to obtain; when the first plants are time-expired other plants will be built on these sites which, I have no doubt, will mask any sealed biological shields which are left there. The sites will certainly not be left as unused and derelict.

MR. P. K. SHAHANI: I should like to ask Sir Christopher if nuclear fission cannot find expression in an elemental frame such as that by which dams express the strength of hydro-electric power. Nuclear fission is costing a lot, and I should like to ask why the nuclear power stations do not express the harnessing of these forces of nature for the benefit of our land?

SIR WILLIAM HOLFORD: The Chairman says this is an architectural point: and I can only say, wait and see. There is a drawing outside which is one of the later perspectives of the design for Trawsfynydd; it has the beginnings of the kind of expression that the last speaker has been mentioning. Quite obviously what is happening inside the nuclear reactors is not directly expressible in terms of building or landscape form; it is an entirely different process from the damming of water; nevertheless I think, or rather I hope, you will feel when you look at that picture that we are trying to

approach a problem functionally and yet with an eye to the kind of shipshape job that has to be done and the kind of landscape in which it sits.

I have been described in the papers as being an optimist about this, and it may be that I am too optimistic, but I think that the question can be answered partly by approaching the problem with absolute sincerity—neither trying to camouflage or decorate the structure in a way which will become very tiresome in a shorter period of life than the life of the reactors themselves, nor attempting just to build any old thing for cheapness and quickness without regarding its effect. You will find, for instance, that enormous care has been taken to do a number of things for the first time: one concerns the reflective value of the material. Care will be taken to ensure that people walking on the hills, for instance, should not see, even when the sun is setting, an enormous blinding sheet of reflected light from the glass facing them. You will find that the artist's impression includes all the switch gear, and the towers which are an inseparable part of the transmission from this generating station, quite frankly and quite obviously; and its design suggests that that too has not been done altogether haphazardly and without any feeling for landscape. You will find that in the proportions of the building the shapes of the rather tall reactors—inevitable, I am afraid—and of the long and lower turbine house do give a reasonable architectural composition which is I think more interesting than the type which I call 'the Three Bears' common to the old-fashioned traditional power stations, where you have the big boiler house, the medium-sized turbine house and the little welfare block at the bottom! In other words we are trying an approach to the general architectural composition, of these things, much more of course through their engineering, because they are engineering propositions, and not fundamentally architectural at all. We are trying to do a functional job and at the same time to pay the utmost possible regard to the landscape. I hope you will have a look at the Trawsfynydd perspective when you go out, and let me know whether you think it is an improvement on some of the older designs.

THE CHAIRMAN: The hour is late and as the last questioner has brought the discussion round to what one might call the more fundamental, the philosophical, aspects of the subject, perhaps this is a suitable moment at which to close. I am sure that this discussion has been of value to us all. I do not think that I am revealing a secret when I say that it was Sir Christopher Hinton himself who proposed the organization of this meeting, and he was quite right. It was quite right that this very contentious question should be brought into the open and discussed on this side by those who are most competent to discuss it, and on the side of the audience by those who are most competent to make comment and to put questions. The extent of the public interest is evident from the debate in the House of Commons the other day. I thought that the opening speech by Mr. Deedes was well worth attention. There have not been many speeches in either House of Parliament as good as the speech he made in moving his motion last week.

Now as to those who are called 'preservationists', those who wish to defend what are called amenities—I do not know whether they have been able to draw very much comfort from this discussion, but there are a number of points of which we might take note. Sir Christopher has shown that he does understand the dilemma which he is in. He has shown a real understanding of a real difficulty. He is himself in favour of public inquiries into the siting of generating stations of the future; and certainly, it is good that the reasons which the Generating Board have for choosing a particular site should be brought into the open. There is also some comfort to be drawn from what Sir William has said. It is comforting that more and more use is being made of landscape architects in all these projects. That duty of course has been laid on a number of authorities by Acts of Parliament, and we are seeing the beneficial results of it. Sir William's last intervention in the discussion showed what care is being

lavished on the project at Trawsfynydd. Now we may or may not agree that it was right to choose that site—the National Parks Commission have a view about that, but I am a referee to-day and not a participant—but we should be ungracious if we did not admit that once a site is chosen the Generating Board do take very great pains to see that the best possible use is made of it. The proof of that is what Sir William has said this afternoon about the care being taken about Trawsfynydd Station. We shall wait and see what the results are, but at any rate a real attempt is being made.

We may also draw comfort from the rules which Sir William has enunciated about the siting of 275 kV transmission lines, and from what he said (speaking personally and not as a member of the Generating Board) about the need in some cases for the lower voltage 11 kV lines to be put underground. And here I would confirm, if I may, what has been said by one or two speakers: that it is those smaller lines, much more than the big ones, the 275s, which give the planning authorities and the National Parks Commission the most trouble. We do recognize that you cannot put miles and miles of 275 kV lines underground; indeed it is very rarely (speaking for the Commission) that we have ever asked for the undergrounding of even short stretches of 275 kV lines. But we do press very hard for the undergrounding of stretches of 11 kV line, and I could wish that the response of at any rate some of the Area Boards could have been a little more positive.

I propose a warm vote of thanks to both of our speakers.

The vote of thanks to the Lecturers was carried with acclamation.

MR. OSWALD P. MILNE, F.R.I.B.A., J.P. (Chairman of Council of the Society): I should like to convey to Lord Strang the gratitude of the Royal Society of Arts and of all of us in this room for coming here to preside this afternoon. We have learned from the papers of the conflict between the claims of industry and the claims of those who are interested in amenities or the land resources of this country. We are encouraged that Lord Strang, Chairman of the National Parks Commission, should come and sit on the same platform as these gentlemen, who are doing the planning for the needs of industry, for he is a man of great influence. That encourages us to believe that the balance will be kept, as far as it possibly can be kept, between the conflicting demands of industry and amenity.

The vote of thanks to the Chairman was carried with acclamation, and the meeting then ended.

INDIANS OF BRITISH COLUMBIA

A paper by

MILDRED VALLEY THORNTON,

of Vancouver, British Columbia, read to the Commonwealth Section of the Society on Thursday, 3rd December, 1959, with Sir Alfred Bossom, Bt., LL.D., F.R.I.B.A., J.P., a Vice-President of the Society, in the Chair

THE CHAIRMAN: You are going to hear a very interesting paper this afternoon. Mrs. Mildred Valley Thornton is herself a Princess of the Kwakiutl Tribe, and there are not many ladies looking as she does whom you would recognize as Princesses of an Indian tribe! Mrs Thornton was educated in Ontario and at Olivet College, Michigan. She studied art at the Ontario College of Art, Toronto, and the Art Institute, Chicago.

As an artist she is acknowledged as an outstanding interpreter of the Canadian Indians and their way of life. She is also known across Canada as a lecturer, writer and historian. Her work has been widely exhibited in Canada and in the United States. Mrs. Thornton has spent much time among the tribes of whom she is to speak this afternoon; all of them hold her in high affection and respect.

The British Columbia Indians are amongst the most interesting in the British Commonwealth. I remember when I was on my way up to the Klondyke at the beginning of the century I first began to notice them for myself, and I collected their work for over forty years; it is some of the most fascinating material in the world.

The following paper, which was illustrated with lantern slides of the lecturer's paintings, was then read.

THE PAPER

In every part of Canada, history as we know it begins with the Indians. No country has a more colourful background with which to reward the student of primitive peoples.

Nearly thirty years ago I began to paint Indians of various tribes in Alberta, Saskatchewan and British Columbia. I have gone alone to these people, painting on the spot portraits of outstanding types and characters. Everywhere I met with unfailing kindness, courtesy and hospitality. Being interested in their history I have sought out those who were leaders, men and women whose lives and deeds gave them eminence in their race. Meeting them in this friendly intimate manner I saw much that was of deep interest to me as an artist. From the human point of view my sympathies were aroused towards a people I soon learned to respect and love and who, I am convinced, have a worthy contribution to make as citizens of Canada.

The Indians of North America are instinctively an artistic people. They have an innate sense of colour and decoration. No inferior race ever produced art of any consequence, but the virile intelligent peoples of the earth have always left their imprint on the life of their times in some form of native culture. That

Tsimshian chief in ceremonial costume, British Columbia.
(This and all subsequent illustrations in this paper are reproduced from paintings by Mildred Valley Thornton)

the Indians of Canada possessed these traits of character no informed person can deny.

Behind everything the Indian does is a reason. He works always to express an idea and with a definite purpose in mind. Think how ingenious they were, how hardy, how versatile. The Indians were able to subsist, wresting with their bare hands directly from nature, food, shelter and clothing. They were able to supply not only the necessities of life, but also many things for their aesthetic enjoyment. Because they lived so close to nature and to the spirit world they were exceedingly psychic, and in their own way, deeply religious. Though the Medicine Men often practised necromancy and indulged in strange incantations over sick people, there were among them prophets and seers of great wisdom who performed many mighty deeds of mystery. These wise men spent much time

in meditation but seldom revealed their thoughts, except to those chosen and trained to succeed them.

Nearly all tribes believed in the Great Spirit, the Ruler of Life, the Mighty Manitou, the Sagalhie Tyee, the Chief above all, eternal, invincible, omnipotent. All believed in the immortality of the soul, and belief in reincarnation was quite common. There were no words for profanity in any Indian language. They had great respect for the dead, but no fear of death. On the Plains, a man composed his own death song and sang it fearlessly as he went out on his last and greatest adventure. A priest who had worked among them for many years in Alberta, told me, 'they die like saints'.

The Indians had myths concerning the Flood, the fall of man and the symbol of the Cross, long before the coming of the white man.

All Indians had many taboos which must be respected. Every man must be ready to work, fight, and die if need be, for the protection and glory of his tribe.

Everything in nature, animate or inanimate, possessed a spirit. Articles belonging to a person were placed on his grave, and it was thought the spirit of the articles belonging to the deceased, departed with him and was used by him in the spirit world. Young men spent long periods of time in solitude till their guiding spirit was revealed to them, and in some tribes a man's own song was given to him in this manner.

Indians were perhaps the most observant people who have ever lived. They knew the life history of all the animals and game they hunted. They knew the flora of their own territory, the edible plants and those that could be used for dyes, tools, weapons and utensils. They discovered many medicinal herbs of great value which are still used to-day. Their sense of sight, hearing and smell were developed to a degree beyond anything that we can imagine. There seems to have been no limit to their knowledge of the natural world about them.

To the Indian nature was an open book, but it was always a book to be cherished and reverenced. Never did he ruthlessly or needlessly destroy anything. He was an instinctive conservator, taking just enough for his needs and no more. The thought of killing for sport was utterly inconceivable to him. In some parts of British Columbia a man would humbly apologize to a bear before killing it for food. Only when he learned the white men's ways did the Indian depart from his native customs.

The Indians were a hospitable race, as all early explorers and traders testify. They would give of their substance without stint and expect no thanks, but for favours received they tried to give full value in return. They never forgot a kindness and because they placed such high value on integrity, they found it hard to forgive an injury. The Cowichan Indians on Vancouver Island are supposed to have been among the most wild and lawless in Canada. Yet Father Leman, who had toiled among them more than fifty years, told me that in the early days of his ministry he never had an instant's concern because of them. White people gave him plenty of trouble, but not the Indians.

This then, is a brief general survey of outstanding traits in our native people.

Winter ceremonial dance of Kwakiutl, British Columbia

With such ideals and such a background who can doubt that they have the ability to play a significant rôle on the national scene?

On considering the Indians of British Columbia, it must be noted that tribes in different parts of this huge province vary greatly in language, customs and traditions. Since it is impossible to deal with all of them in the limited space available I shall concentrate mainly on the Northern Pacific Coast, where there existed not so long ago an exctic native culture for which there is no counterpart in all the world.

No one knows how long the Indians have been there, but excavations in the great Fraser Midden near Vancouver testify that there was a flourishing community on that site 2,000 years ago—at the time of Christ, think of it—and no one knows how long before that. Remains of vast community houses were found, also skeletons, ornaments, weapons, tools, utensils and the like. This great camp site (for that is what a midden is) covered an area of $4\frac{1}{2}$ acres, the largest yet discovered. Clam shells to a depth of 15 feet indicate a large population and a bountiful food supply. More recent explorations in the interior of the province have established Indian habitation 6,500 years ago.

Anthropologists, archæologists and students from many parts of the world have come to study the ancient customs and traditions of our Coast Tribes, and to carry away with them priceless examples of their skilled craftsmanship.

Nearly all anthropologists believe that Indians of British Columbia are Mongolian in origin; that in ages long past spasmodic migrations of primitive people came across the Bering Strait from Siberia, and found their way by degrees down through Alaska and into the more congenial climate of British Columbia.

Nature was kind to the Coast Tribes. For Indians on the Plains, life was an unending struggle for existence under the rigours of a harsh climate, with great extremes of heat and cold, and very little natural vegetation. Winter and summer they had to follow the buffalo and win by their own exertions the necessities of life.

In contrast, how different was the lot of their brothers on the Pacific Coast. With a moderate climate, in the midst of the greatest spawning grounds in the world, these Indians had access to an inexhaustible food supply, obtainable with ease. Many materials were readily accessible for their use. The all-important cedar tree, spruce, mountain-goat wool, shells, stone, jade, horn and argilite were utilized with marvellous skill and ingenuity. With prudent foresight they laid by vast stores of food for the winter months, which was a season for feasting and social enjoyment. Using stone axes and wedges, they cut down the mighty cedar trees to build their enormous houses sheltering many families under one roof. Also from the cedar tree they made their stout dugout canoes, which gave them great mobility of action. Cedar trees of tremendous height and girth were used for their gigantic war canoes. Some of these, handsomely carved and painted, were capable of holding up to sixty warriors. In war canoes, the proud fierce Haidas from the Queen Charlotte Islands roamed the entire coastline for hundreds of miles, the envy and terror of all other tribes.

From the cedar tree Coast Indians made their totem poles, grave boxes, masks, food boxes, utensils and innumerable other things. The inner bark of the cedar, pounded and shredded, was woven into fine material for clothing, hats, mats, and for ceremonial purposes. Beautiful baskets, decorated with native designs in wild cherry bark, were made from the roots of the cedar tree.

There were no nails, of course, in their great houses. They were fastened securely together with cedar rope but could easily be dismantled and transported to other places for the seasonal run of fish or gathering of berries. Later, they would be taken back again to their permanent location for the winter ceremonies.

Theirs was a highly competitive society, where rank, wealth and prestige were of primary importance. Family crests as portrayed by natural symbols were carved on the massive totem poles to proclaim the greatness of the owners.

Among the Kwakiutl were three rigidly defined classes: the nobles, the commoners and the slaves. In early days there were frequent intertribal raids to obtain booty and to carry away captives into slavery. A 'high person', as the aristocrats were called, was expected to maintain a dignified, aloof manner, to keep his own counsel and deport himself in a manner befitting his exalted station.

The Indians had powerful secret societies to which only the nobles belonged.

Chief Shot-on-both-sides. Blood Indian, Alberta

Only the nobles took part in the elaborate dance ceremonies and secret rituals, and only they could wear the richly carved masks and traditional blankets.

Names, songs and dances were personal property of great value, and were not transferable without the owner's permission. Family crests depicting the raven, blackfish, grizzly bear, thunderbird, eagle and other creatures were jealously guarded and passed from generation to generation with all the rights and privileges pertaining thereto. In some tribes this was through matrilineal descent, in others through the male side of the family. Additional crests could only be obtained through marriage, and no one was permitted to marry beneath his or her rank.

Women had great power 'behind the Throne'. Some of them were chieftainesses in their own right.

Minnie Milo. Interior Salish Indian, British Columbia

A man could not carve his own totem pole, even if he had the talent to do so. Someone from a different clan must do it for him. This interdict was to guard against the wrongful use of crests.

Totem poles were never objects of worship, as some of the early mssionaries mistakenly believed. Their significance was entirely social. A man's crests might be carved on massive house posts inside his dwelling or on a tall pole outside, or both. Sometimes entrance to the house was through the lower part of a totem pole. When a Haida chief died his remains were put in a grave box deposited on the top of a mortuary pole, which was carved and painted in native designs. At this time a new pole was erected which served a dual purpose. It was a memorial to the departed and also a public proclamation regarding the heir to his crests.

Tradition says that the first totem pole ever carved came floating in to Langara

Island, most northerly of the Queen Charlotte group of islands, long ages ago, presumably from the spirit world.

The Kwakiutl on the north-east coast of Vancouver Island and the mainland and adjacent islands, the Haidas from the Queen Charlotte Islands, and Tsimshian Indians in the vicinity of the Nass and Skeena Rivers produced the finest totem poles ever carved. Nootka Indians on the west coast of Vancouver Island and the Bella Coolas also made totem poles, but they were less numerous and less spectacular than those of the above-mentioned tribes.

Though the Indians of British Columbia undoubtedly did some carving long ago with their crude native implements, their work received tremendous impetus when they came into possession of white men's tools. It is thought that the most prolific period of their carving does not extend over a period of more than 150 years. The art is almost non-existent to-day, but impressive remains of fabulous images may still be found in remote villages long since abandoned for more profitable locations. Here the immutable forest is slowly and relentlessly reclaiming its own. The sightless eyes of thunderbird, eagle and grizzly bear lie prone and pitiful under a mantle of fern and moss. Grave boxes have disappeared from the tall mortuary poles and birds have dropped seeds where the bones of a Haida chief used to repose. Now little vines and trailing tendrils of huckleberry and sal-lal hang down over the once proud features with ridiculous impropriety. The silence is unbroken except for the timeless music of the sea and the mournful croak of a raven.

THREE TALL TOTEMS

Three tall totems gazing out to sea;
Three tall totems so quiet and still;
Standing under a tall dark hill,
With their sad gaunt eyes searching endlessly.

The thunderbird, the fish and the bear
And the lone wolf with his aching jaws;
All in accord with the Indian laws;
All looking out with a wide frozen stare.

Three tall totems waiting patiently
For the quick tread, the unspoken word;
Waiting for the voice that is never heard;
Waiting in the silence by the long grey sea.

Mildred Valley Thornton

Artists were highly regarded in the old days. Only they were capable of preserving in visible form the symbols on which the native society was established. The artist worked in constant collaboration with the song-maker, the dancer and the story-teller.

The potlatch was the focal point of social activity among all coast tribes. It was a 'giving away ceremony'. The more a man gave away the higher he rose

Bella Coola mask dance. Interior Salish, British Columbia

in his own estimation and in that of his fellows. Sometimes called 'the gift feast', the potlatch was usually held to celebrate an important event. A man might work for years to accumulate enough money and goods to hold a potlatch, then 'call' the people of neighbouring tribes to witness his wealth and generosity. The ceremonies lasted for days, perhaps weeks, the giver of the potlatch providing food for all the people. Often his relatives would help him, if need be.

It was a period of feasting, dancing, singing and grandiloquent oratory. A chief was not burdened with modesty when he began to boast of his wealth and rank. Fantastic quantities of goods were given away with reckless abandon: silver and gold bracelets, engraved with tribal designs, baskets, blankets, clothing, furs, guns, canoes, and in later years furniture, flour and money running into thousands of dollars.

Treasured above all else was a chief's copper. In the early days raw copper was obtained from natives of Alaska through barter. This was then hammered out into a flat shield-like form on which was etched the chief's most important crest and other insignia. The most valuable coppers had names of their own and legends about them. The incontestable proof of a chief's opulence and superiority was confirmed in the breaking of a copper. One of the old chiefs whom I have painted had paid $24,000 for a chief's copper. He then held a great potlatch and with magnificent disdain broke it before his guests and gave the pieces away.

Long ago the potlatch was forbidden by law, the Government contending that it impoverished the Indians. It undoubtedly did so, but at the same time it was a powerful stimulus to industry and it was the fertile soil out of which their astonishing native art emerged. Moreover, it was a guarantee of future welfare. Each recipient of a gift was in honour bound to return at least double the value received to the donor or his heirs, at some future day when he also could give a potlatch. No written records were kept, but everyone knew who owed whom and how much.

There were things in the old Indian way of life that were most admirable. They had many sterling qualities that we would do well to remember. To our shame it must be admitted that too often we have taken to them our vice and our weaknesses instead of our strength and our probity. Far too often they have been the victims of cunning and exploitation by unscrupulous white men, until it is no wonder that they learned to copy our devices. In pure self-defence they had to learn the rules of the game as we played it. The only wonder is that they stood up so well under the test.

Perhaps, human nature being what it is, it was impossible to avoid this exploitation; but to a large degree that phase of history is long past. The efforts of our various Governments, while not radical or spectacular, have in the main been constant and sincere.

I have observed and studied these people as I went among them, and have tried to learn something of their present condition, the problems that confront them, and their hopes for the future.

Transition from one form of existence to something that is entirely different is not a happy experience, nor is it accomplished within the span of a few brief years. Not easily are old habits forsaken, not without pain are old links broken.

We face many a challenge to-day in endeavouring to preserve an ancient culture, while at the same time we are working to break down the very things out of which that culture grew. The Department of Indian Affairs at Ottawa is doing much to aid the Indian in the process of assimilation. We cannot close our eyes to the fact that this is the future which awaits him. He cannot remain forever on the reservation, an oasis of stagnation in the midst of a rapidly advancing civilization.

The health of Canadian Indians has greatly improved in recent years, with a resultant conspicuous rise in population. Smallpox, the great killer in early days, is no longer a hazard. Tuberculosis has been almost eliminated. Vigilant health officials see that all Indians are X-rayed every year.

All this comes about not only through improved medical services, but also because of greater co-operation from the Indians themselves. In the beginning, Medicine men and Medicine women were highly resentful of Government interference in what they regarded as their rightful domain. Indians were suspicious and afraid to let their loved ones be taken many miles away to hospital under the care of white people. Slowly the old prejudice was broken down, giving way to confidence and co-operation, as the Indians began to see for themselves the results of sustained professional treatment.

Now Indian girls take up nursing and home care. Indian boys come back from the schools with new ideas. Gradually the process of transition is being wrought.

The only effective and permanent way to better the lot of our native people is through education. In this case, education means changing the habits and thoughts of people, and this of necessity cannot be hastened unduly. New ideas can be poured into the human brain, but it is difficult to eradicate old ones, which are the result of centuries of habit and tradition. The greatest hope lies in the children of to-day who will be the fathers and mothers of future generations.

In the early days the only education available to Indians was in the residential schools, owned and operated by the Government, in conjunction with churches interested at that time. These schools, some of them in very remote areas, served a useful purpose then, and are still needed to-day. Clergymen from the Anglican, Roman Catholic and Methodist Churches did heroic work under most difficult conditions. For the most part the missionaries were a noble breed of dedicated men, and few of them remain to witness the fruits of their labours.

In the case of migratory tribes, children could be left in the safety and comfort of the schools while their parents were away trapping or fishing for long periods of time. Orphaned children were given loving care in the residential schools. As the country became more settled new schools were built to meet the needs of the situation at the moment.

I have heard people complain that children in residential schools had to spend part of the day in manual duties. Actually, besides helping to maintain the schools at no cost to the Indians, this was a vital part of their education. Girls learned to cook, wash, sew and do many things their parents never taught them because they had not needed this knowledge themselves. Boys gained useful instruction in farming, machinery, carpentry, and in some cases, boat building, all in addition to their regular school work. Sports and recreation had their assigned part in the programme.

Later, the Government built day schools on the reservations, where pupils put in full time at their studies under qualified teachers who followed the regular provincial curriculum. In recent years official policy has been to co-operate with municipalities in building and maintaining both public and high schools which Indians attend as a matter of course with white children.

More Indian young people go to university every year, many more attend high school. We have to-day Indian lawyers, doctors, ministers and successful business men.

All this redounds to the credit of officials at Ottawa. A large measure of authority has been granted to workers in the field, who are more intimately familiar with local conditions than the head office could possibly be. It is extremely important, therefore, and I must stress this point, that the right people be chosen for this work which demands so much tact and understanding.

Eventually more responsibility must be placed on the Indians themselves, and this the Government is trying to do at many levels. Conditions vary greatly in different parts of the country. Methods that are good and feasible in Ontario

Harriet Yellow-Mud-Blanket. Cree Indian, Saskatchewan

and Quebec will not work in Alberta or Saskatchewan, and problems in British Columbia are in another category entirely. But the overall picture and the overall needs are the same. Indians require exactly the same things that we do: health, education, and an equal chance to make a living.

Under one of the most solemn and binding treaties Canada has ever entered into, we have guaranteed to the Indians for all time the exclusive rights and uses of large tracts of land along with certain special privileges. What we got out of the bargain was immeasurably more than we gave, but it was the result of careful thought and consideration by all parties concerned, including the Indians, and seemed to be the best answer at the time. In the poetic and picturesque language of the Indians themselves that treaty was to stand 'As long as the sun shines and the waters flow'. Not all Indians signed treaties with the Government, but all received reservations and guaranteed aboriginal rights.

That treaty was no mere scrap of paper to succeeding Governments. Not one inch of an Indian reservation can be bought or sold without the consent of the

whole tribe. In some cases land has been sold under these conditions and the money held in trust for the Indians for tribal uses.

All this goes to show how precious and enduring is the Indian's love of the reservation and how sacred are our obligations to him in this respect.

Yet, on the other hand, how are we going to forward the process of assimilation by following a policy of segregation and isolation? It just doesn't add up. For a people to become fully integrated into the fabric of citizenship they must be prepared to assume its responsibilities as well as its privileges. I believe that many Indians are now fully capable of assuming such commitments; that, given the opportunity, they would rise to the challenge and rapidly adjust to higher standards.

Paternalism has serious weaknesses and this is a very grave problem that the Indians themselves must consider and solve in due course. Until recently it was unlawful for Indians to buy or be given spirituous liquor. They were denied this doubtful privilege in early times to protect them from avaricious white men who sought to debauch and exploit them by depriving them of their senses. Times have changed and Indians have changed too. Where restrictions on the sale of liquor have been removed, the results have been disastrous in some cases. Other Indians have stood up splendidly under this new test of character. Some of the wise old chiefs will not allow strong drink of any kind on their reservations. Probably they handle the situation quite as well as white people would do under the same circumstances.

As wards of the Government, Indians do not have the federal franchise. In British Columbia Indians may vote in provincial elections. All Indians in the armed services (and many of them fought bravely in two world wars) automatically have the franchise. An increasing number of ambitious younger men have voluntarily foresworn their aboriginal rights in order to vote in full equality with their white brothers.

There is a growing demand that Indians everywhere must have the federal franchise without giving up any of their guaranteed privileges. Surely, this is not too much to grant the original owners of the land.

Financially, Indians of British Columbia are better off than they have ever been. In the interior of the province, some make a fair living at trapping, which is a diminishing occupation. Others do very well raising cattle, logging, working in lumber mills and canneries. In the Chilcotin, Indians periodically harvest Christmas trees in quantity that are shipped all over the Continent. Along the coast monetary conditions changed radically during the last war. When Japanese fishermen were removed from the coast as a security measure, Indians resumed an ancestral occupation from which they had long been excluded by Japanese monopoly. Working hard for long hours, they gradually paid for their own boats. To-day many coast Indians are very well to do indeed, with fine homes, good cars and many of the comforts of life.

One must not discount the influence of the powerful 'Native Brotherhood' representing Indians from all parts of the province, and the 'Native Sisterhood' to a lesser degree.

Intermarriage with whites is becoming a commonplace, to the mutual benefit of both races.

Under the Canadian Pensions Plan Indians benefit materially, receiving the same emoluments as white people. With no rent to pay, no taxes, free medical care and other privileges, they are actually better off than many indigent white people in the same category. Indians everywhere gladly accept Family Allowance from the Government of Canada as a financial aid for their children.

Able and educated Indian men and women are working hand in hand with interested white people for the betterment of their race. In British Columbia an Indian university graduate, Mr. Frank Calder, gave a good account of himself as an elected member of the legislature. Dr. Peter Kelly, a full-blooded Haida Indian, was the distinguished president of the United Church Conference in British Columbia. An Indian man from Alberta, Mr. James Gladstone, is the first native to be appointed to the Senate at Ottawa.

As a group, Indians of Canada still need wise guidance, sympathy and genuine friendship in a partnership which has nothing but good to offer to all concerned. Indians have special talents and unique endowments which should find full expression in the wider sphere, bringing them consequent prosperity, self respect and happiness, and thereby enriching the social, cultural and spiritual life of the nation.

DISCUSSION

THE CHAIRMAN: It is a great pity that the totem poles, which are fascinating, should be disappearing so quickly. Not many of the original ones are left. When I was first in these parts, a little more than fifty years ago, there were places where one could see stacks of these totem poles.

MR. H. G. LOWDER: In one of the illustrations there was a door which appeared to be hinged halfway, so that it swung horizontally. Is that so, or was I mistaken?

THE LECTURER: Yes, some of the doors on the old houses are hinged like that. They were not built according to specifications which we would use or recognize!

SIR HARRY BATTERBEE, G.C.M.G., K.C.V.O. (Royal Commonwealth Society): The lecturer mentioned slavery. Could she tell us about the institution of slavery amongst the Indians, and when it came to an end?

THE LECTURER: The peoples along the coast in particular were very class-conscious. Amongst the Kwakiutls, for instance, the class distinctions were very rigid since a remote period. The value attached to slaves had its origin in the fact that these tribes were always trying to outdo each other in prestige and pride of place. Slaves were an indication of wealth. And, of course, the 'high people', as they were called, would not demean themselves by manual labour if they could get other people to do it for them. Sometimes a captured chief from another tribe would become a slave, unless he managed to escape to his own people.

According to the records, the slaves were mostly well treated, although there have been cases to the contrary. It has been said, for example, that in the very early days the Haidas, when they were erecting a great totem pole, as an indication of their disregard for wealth would throw a slave into the hole before they put the pole up, and it would fall on top of him.

I do not know of any definite date when slavery came to an end. It was gradually abandoned under the influence of White penetration.

MR. A. POWIS BALE: This giving of many presents and blankets—I did not catch the name of the party at which it was done.

THE LECTURER: The potlatch. I wish I had more time to tell you about it. Its object was to demonstrate their riches. As I have said, wealth and position meant everything to these people, and a man would work for years to collect enough goods (and in later years, money) just to give them away. He would call the people from the different villages all along the coast to come, and they would be his guests for days, perhaps for weeks. There would be a great feast, dancing and singing, he would feed these people, and then the climax of the whole thing was the giving away of his accumulated goods. The Government outlawed the potlatch long ago because it was said to impoverish the Indians. But it is still done, socially.

The potlatch was not merely ostentation of goods. The ceremony provided the fertile soil in which their art grew. The carving of all these crests resulted from this great urge to outdo everybody else; the more crests a man had the more important he was; the more he gave away, the higher he stood in the opinion of everybody else and in his own opinion. There was a very good reason for it too, because everything that was given away was given on the understanding that each recipient would at some future date also hold a potlatch and return at least double the value he had received. So that potlatch was a means of display, both material and artistic, and a sort of primitive insurance!

MISS JEAN MACRAE: To what extent were the various tribes influenced by the Christian religion?

THE LECTURER: In the earlier days Christianity did not have a great impact on them, but some of the things that the missionaries taught them were not very different from what the Indians already believed. They saw their God in everything; nature was the expression of the divine spirit. When a man died they left his possessions on his grave because they thought the spirit of these things went with him into the next world and could be used by him there. They lived very close to the spirit world, so I do not think it required a great effort for them to accept some of the simpler tenets of Christianity that the missionaries taught. Some of the early missionaries devoted their whole lives to Indians: as teachers, preachers, doctors, nurses, friends and lawyers.

MR. NUGENT M. CLOUGHER: There are three very interesting points arising from this most interesting lecture to which I should like to refer. First, where are the principal tribes found in British Columbia? On the coast, or in the Rocky mountains, or in the north? My second point is in connection with the interesting reference to the Mongolian strain in the Indians. Archæology in Mexico has revealed a strong Mongolian influence there, and yet you find practically nothing in common between the Canadian art and Mexico.

My third point has to do with totem poles. Does Mrs. Thornton agree that poles are divided into two parts; one part indicating the crest of the tribe, and the other the descendants of the tribe based on marriage?

THE LECTURER: There are seven ethnic groups in British Columbia, and they are scattered all over the Province. I have tried to give you representative pictures of them all in the portraits I have shown tonight.

About the Mongolian influence—archæologists and anthropologists think that these peoples came across from Siberia long ago and there are many things which seem to indicate that that is their origin. There are a number of reasons for this conclusion, and personally I think one of the strongest proofs of their Mongolian origin is the presence of what is called the Mongolian spot on Indian children. All Indian children have this spot of dark discolouration on the skin, at the lower part of the spine, when they are born; even if they are only quarter-blood, they say

it is there. The spot is just like a smudge of dark colour, and it vanishes in a few years time. I am told that all Mongolian people have that spot. Doctors and nurses have verified this.

The totem pole displayed the important crests of the family of the Chief; he would not have any additional crests, he could not get them except by marriage. I have heard of babies being betrothed to somebody else in another tribe simply because the chief of that tribe wanted the girl's family crest to put on his totem pole. Perhaps when these children grew up they never saw each other again.

I wish I had the slide of what they call the weeping totem from the Queen Charlottes. It is quite a famous totem pole, showing a chief with long tears streaming out of his eyes. There are frogs on the pole in two or three places, and little heads that indicate children. The story is that many, many years ago, this chief was going away with his braves on a hunting expedition, and as he would be gone for some time, he left the little boys in the village to guard the fires.

Now there was a legend amongst the Indians, who greatly revered animals, that if they were ever unkind to them some great disaster would befall them. The children played around, and after a while wearied of looking after the fires. Looking for something more interesting to do, one of them found a frog, which he threw into the fire. The frog began to cook, and got hotter and hotter, and it exploded. The children thought that was very funny, so they got a lot of frogs and threw them on the fire and put the fire out. When the Chief returned and saw the fire out, he wept bitter tears because he could foresee some dreadful disaster coming on his people. So this magnificent totem pole records the legend, and the great disaster is supposed to be the coming of the white man!

THE CHAIRMAN: I am sure you would like me to thank Mrs. Thornton warmly for this delightful story.

The legend she was talking about reminds me of one. Forty years ago I happened to acquire a grave totem of the Raven clan. The story of it is this. In heaven was a father who had a son; on the earth there was another God who had a daughter. All the world was dark, so the heavenly father told his son to go down to the earth and light the world. The son turned himself into a leaf which floated down the river, and the daughter of the earthly chief dipped her hand into a brook for some water and swallowed this leaf. In due course she had a child, which was regarded as shameful because she was not married. However, they took her and the child into the house where there was a box containing the sun, moon and stars; and when the child was very good they gave him a star to play with, and he would throw it up in the air. So in due course there were a number of stars in the sky, and one day when the boy was left in the house by himself, he opened the box: threw up the sun, threw up the stars, threw up the moon, and lit the world. The Indians then knew at once that the heavenly father had sent his son down to light the world against their desire; so they rushed back to try and kill him. The boy turned himself into a raven and he had to fly up through the smoke hole of the house, and that is why a raven is black to-day! As he was going up to see his heavenly father he had to wear his three-ringed hat, because you cannot see your heavenly father without a three-ringed hat; and as he had a long journey he held a great staff in his hand; and as he had to go up through the small smoke hole the beak of the raven totem was made to take off!

In this legend one can find a certain similarity to our belief that our Heavenly Father sent his son to bring Christianity to the world.

I know I speak for everybody when I tell Mrs. Thornton how much we appreciate what she has done; she has given us a fascinating story of a people which will all be written down in our records and which we shall be able to read again and again as the years go by.

The vote of thanks to the Lecturer was carried with acclamation, and the meeting then ended.

GENERAL NOTES

ITALIAN ART AND BRITAIN

Erminia discovering the dead Argante and the wounded Tancred. *By Francesco Guardi.* (*From the exhibition 'Italian Art and Britain' at the Royal Academy*)

Professor E. K. Waterhouse's admirable idea of illustrating the leanings of British collectors of Italian art from the time of Charles I to the present day—as well as the influence of its heritage on Wilson, Reynolds, Turner, and many more—is given effect in the Royal Academy's Winter Exhibition. Drawn entirely from collections in Britain, it could not be as illustrious as the congregation of Italian masterpieces here in 1930. Nor, in its nature, could the exhibition present a tidy chronological review of schools and styles. But in tracing something of the growth and history of British collecting and reflecting the changing taste for things Italian, this assemblage stirs the historic sense of English visitors as few of its great predecessors have done. Here you recognize with a smile the apotheosis of Charles II arrayed in classical armour and ruling the seas, as celebrated by Antonio Verrio; here recapture the snuffy odour of Johnson's circle in the endearing person of Baretti squinting at a book before his nose, painted *con amore* by Reynolds for their familiar Thrale.

What puts the visitor in excellent spirit from the outset is the general cleanliness of the paintings and the appearance of the redecorated rooms. Fresh cream or maroon backgrounds and refurbished gilding allow one to see just how handsome, for example, the main gallery really is. The Venetians of the High Renaissance, favoured by our acquisitive aristocracy since the seventeenth century, bring a magnificence to this great *salon*, if not every example can compare with the National Gallery's. Dominating the room in drama and magnitude is one of many works from the Royal Collection: Tintoretto's *Esther and Ahasuerus*, a harmony of bronze, rose pink and ivory, the movement of eloquent arms and gestures flowing about the still centre of the supported woman. The Venetian master is finely represented also by Sir Kenneth Clark's *Portrait of a Young Man as David*, and in the strange, gliding dance of *The Wise and Foolish Virgins* where, not for the first time, one is struck by a curious affinity between the other-worldly figures of Tintoretto and the spectral nature of certain Henry Moore drawings. Veronese is seen most splendidly here in the recently cleaned *Martyrdom and Last Communion of St. Lucy*, and Titian in the *Young Man with a Glove* from Lord Halifax's collection which is sometimes given to Giorgione, but appears to point rather to the young Titian under Giorgione's influence.

It is, in fact, in the first rooms that the ethereal realism of Giorgione is most hauntingly seen in the examples from Hampton Court. Everything here illustrates the British devotion to Italian art before 1700, commemorating the 'father' of English collecting, Thomas Howard, Earl of Arundel, and bringing us some of the celebrated paintings which entered the Royal Collection under Charles I and Charles II. In the large South Room beyond, where are reassembled sections of five of the greatest of the early collections of Italian drawings, it is very properly the Earl of Arundel's wall of Leonardos and Parmigianinos which has pride of place. But it is a wealth of drawings, demanding frequent study rather than enumeration, which illustrates also the taste of Lord Somers, the older Jonathan Richardson's predilection for the *quattrocento* studies, and the supreme exemplars owned by Lely and Thomas Lawrence.

Tempting as it is to linger on these heights, the exhibition's peculiar fascination—the cultural interchange—lies in the range of galleries beyond. Here we find Reynolds, returned from Italy and afire with the Grand Style, yet finding sustenance rather in Rembrandt in his portrait of his young Roman assistant, Marchi. Here, elaborating the pictures and British *cognoscenti* in the Uffizi Gallery is Zoffany, and all those Grand Tourists recording the Pantheon, the Cascade of Tivoli, the firework display in honour of Pope Pius VI. The breadth of form and luxury of colour which they came to study were not theirs to command, but excitement and awe can still be felt. On the fringe there frisks the assiduous Tischbein, and Pompeo Batoni in Rome, portraying the Englishman abroad. And forsaking the Venetian scene in this two-way traffic comes Canaletto to paint his expansive views of Badminton and of Warwick Castle.

We move into loftier and more familiar regions in Gallery IX and the reshaped Lecture Room, where the earlier Italian paintings are marvellously congregated. Here are commemorated those Georgian connoisseurs and collectors led by William Roscoe of Liverpool, whose perspicacious taste for the Primitives was later shared, as we know, by the Prince Consort and the National Gallery's first Director, Sir Charles Eastlake. Of the pictures mainly of the Sienese school in Gallery IX, the most precious are the three examples of Simone Martini, and the Prince Consort's acquisitions—the Duccio triptych and the great Gentile da Fabriano, *The Madonna and Child with Angels*. The Lecture Room has never been so finely hung as it is now with treasures as valuable as the Academy's marble relief by Michelangelo and Botticelli's Medici portrait lent by Sir Thomas Merton. Moving into the Octagon we find the lately discovered figure compositions reasonably given to Francesco Guardi inspired by Piazzeta's engravings. Broadly and vivaciously handled, with

a natural light that flickers over blown mantle and flesh, the larger decorations have something of the aspect of tapestry. Indeed, the summary passages and rather chancy grasp of form suggest that these breezy allegories should properly be viewed from a distance and could well be raised.

Though the exhibition closes with the Italian eighteenth century—a whole wall being devoted to Tiepolo's small and airy oil sketches—the later emphasis is understandably on the Seicento. The swing of critical taste in favour of this school in the last twenty years is due in large part to the ardour of specialist collectors such as Mr. Denis Mahon, who is entrusted with this selection. All the pristine gloss is recovered in these cleaned paintings whose tendencies are now familiar—the academic perfection, and the demonstrative aspiration of the religious style. The play of light and half-shadow in Guercino's *Mystic Marriage of St. Catherine* or the astonishing painting of the ass's head in the Cerano, speak for a lore beyond recovery, even if it were relevant to-day. The Italian tradition in Britain was stifled and expired with the Victorian Olympians.

NEVILE WALLIS

STUDIES IN THE SOCIETY'S ARCHIVES X

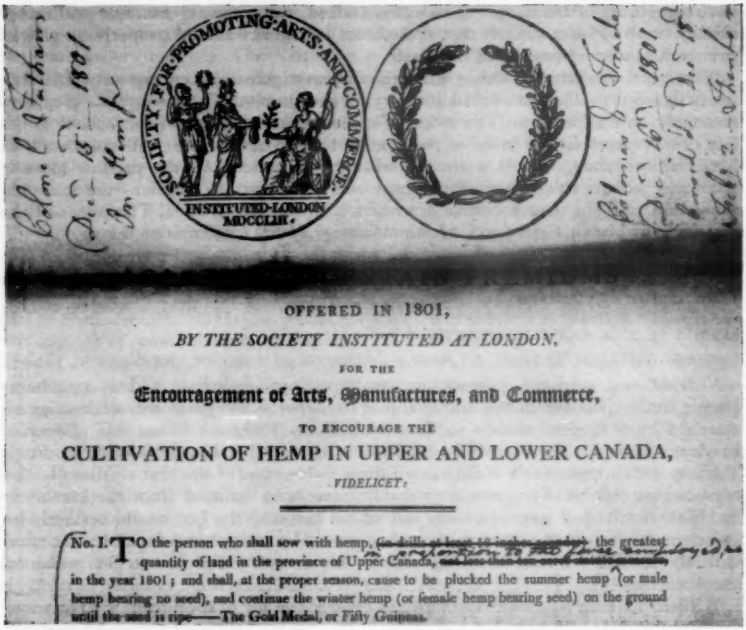
Colonel William Tatham, an Anglo-American Member of the Society, 1801–4

'Adventurer, surveyor, geographer, inventor, agriculturalist, soldier, merchant, lawyer, author, book-collector and friend of the great' is the portmanteau description attached by a modern author to Colonel William Tatham.[1] When due allowance has been made for the versatility common in his time, it is still possible to credit Tatham with a remarkable ability in all these fields,[2] and if the first epithet may be regarded as pejorative—it would probably have been omitted from the catalogue had Tatham made a success of any one of his careers—the last would certainly be sufficient to warrant the interest of the historian. His intense and fruitful association with the Society of Arts is an episode in his career which has so far remained unrecorded.

William Tatham was sent to America in 1769 at the age of seventeen 'with no more than one single family guinea in his pocket'.[3] In 1796 he returned to England qualified in all the spheres listed above. He published books, tracts and articles on the economic resources of North America, on canal development and irrigation.[4] His style was generally ponderous but was enlivened by personal idiosyncrasies which appealed to the reviewers.[5] In the early part of 1801 he was put in charge of the office of works at the London docks at Wapping, but as he himself put it, 'on this occasion . . . he was somewhat mortified by the idea of checking his own ideas in favour of those of others'.[6] In July he left the dockyards[7] and on 16th December he wrote his first letter to the Society of Arts.[8]

His letter was in response to a request for information about the cultivation of hemp in Canada. Since the seventeenth century mercantilist politicians and economists had been aware of the national value of this fibrous plant, which could not only employ the poor and make waste land profitable, but which might free the British navy from its dependence on foreign cordage.[9] Before the capture of Quebec the French royal government had encouraged the cultivation of hemp in Canada.[10] In 1790 the Committee of the Privy Council for Trade and Plantations co-operated with the Agricultural Society of Quebec and the Provincial Government in offering bounties for hemp production.[11] In 1801, when naval stores were in great demand at home, the Society of Arts began to offer rewards.

Notices containing details of the Society's rewards were sent to Canada in April, but December came without any claims having been received.[12] It was evident that the conditions imposed on candidates were in need of modification. One of the members of the Society's Committee of Colonies and Trade, Joseph Colen,[13] a former Governor of York Fort, Hudson's Bay, approached William Tatham and asked his advice. Tatham responded with a letter to Charles Taylor, the Secretary of the


SOCIETY·FOR·PROMOTING·ARTS·AND·COMMERCE
INSTITUTED·LONDON
MDCCLIII·
OFFERED IN 1801,
BY THE SOCIETY INSTITUTED AT LONDON,
FOR THE
Encouragement of Arts, Manufactures, and Commerce,
TO ENCOURAGE THE
CULTIVATION OF HEMP IN UPPER AND LOWER CANADA,
VIDELICET:
No. I. TO the person who shall sow with hemp, quantity of land in the province of Upper Canada, in the year 1801; and shall, at the proper season, cause to be plucked the summer hemp (or male hemp bearing no seed), and continue the winter hemp (or female hemp bearing seed) on the ground until the seed is ripe——The Gold Medal, or Fifty Guineas.

Part of a notice offering premiums for the cultivation of hemp in Canada, with manuscript corrections by William Tatham. (R.S.A. Loose Archives, A16/4)

Society, which stressed his own great experience of North American agriculture, avoided mentioning the fact that he had never been to Canada, and suggested that the Society should change its offer of a single large reward to a number of varying amounts and that it should reward the shipment of hemp from Canada to Great Britain as well as the actual cultivation in Canada.[14] On 15th and 20th January, 1802, the Secretary received two more letters from Tatham. These contained historical evidence for the growth of hemp in New England and Canada.[15] All three were taken into consideration by the Committee of Colonies and Trade on 2nd February.[16] Tatham's suggestions were incorporated into the Premium list for 1802, and planters and exporters began to claim the rewards.[17] On 3rd and 8th February, 17th March and 17th April he sent further letters embodying the results of extensive research into the subject.[18] In the meantime, on 10th March, he had been elected a member of the Society[19] and was serving on the Committee of Colonies and Trade.[20]

Being 'impressed by the lively sense of the attention paid [to him] by the Society . . . concerning the important branch of trade under consideration', Tatham had presented it with a bust of George Washington—of whom he wrote to the Society, 'no temptations of popular power, or selfish emolument had sufficient charms to bias his mind from the walks of piety, private retirement, and domestic benevolence'.[21] After his election he presented copies of his book on irrigation and 'my three pamphlets on the subjects of Agriculture and Commerce',[22] and within three weeks of joining he had laid before the Society a manuscript essay 'on the

extension of Commerce and the culture of latent resources in America'. In this he argued 'that the ordinary attention paid by the Society to the department of *Colonies and Trade*, has by no means kept pace with the progress of human changes, but is restricted by a constitution varying wide from the essential intendment of this honourable establishment, which evidently contemplated to benefit the nation by the results of a traffic connecting itself as an *extrinsic advantage*, whether *colonial* or, more expressly, *foreign*'. The Society, Tatham argued, should therefore do all it could to encourage the exchange of knowledge between Great Britain and America, and the best way to achieve this aim was to appoint a number of United States citizens as Corresponding Members.[23]

Tatham was not without support in his scheme for extending the Society's interest to the United States. Proposal slips for eight American Corresponding Members are still preserved, and they each contain the signatures of Tatham, William Lumley and John Robinson. Lumley was a chairman of the Society's Committee of Accounts and Robinson an influential Member of Parliament.[24] But the general feeling in the Society was clearly hostile to the proposals. Tatham was accused of having taken the names of his suggested Corresponding Members from a newspaper, and fears of foreign domination were expressed. In defence of his nominations Tatham 'was precipitated . . . on the floor of discussion . . . in an awkward predicament which I shall not easily forget'. The morning after, he wrote to the Duke of Norfolk, President of the Society, withdrawing his nominations, which, as he rightly prophesied, 'may remain in your archives . . . an index of honour and virtue till the mouldering of time shall destroy them'.[25]

His rebuff in the matter of American Corresponding Members did not bring to an end Tatham's association with the Society. He was present at a meeting of the Committee of Colonies and Trade within three weeks of his 'awkward predicament'. Records of occasional attendances by him at that and at other committees and at full Society meetings continue until May, 1804.[26] In 1803 he was successful in increasing the award which had been voted to a tree-planting candidate,[27] in modifying the offer of premiums for engravings,[28] and in a scheme for extending the capacity of the Great Room.[29] On the more significant matter of canal development, in spite of his published works on the subject, he failed in his attempts to influence the Society.[30] In the spring of 1804 he brought to the notice of the Society the manufactures produced by the pupils of a school for the indigent blind in Lambeth, and received a vote of thanks in consequence.[31] By this time it would seem that neither the Society nor Great Britain could provide the opportunities which Tatham sought in his plans to influence public policy. Later in the year he approached his old friend James Monroe—at that time in London—with a view to obtaining employment from the United States Government.[32] In 1805 he returned to America, and remained there until his death in 1819.

Tatham's last years were passed in poverty and intemperance. He had influential friends and admirers, but they could not save him from himself nor, in the end, from the suicidal urge to jump before an exploding cannon's mouth on the birthday of his hero Washington. In London the event was recorded as 'one of themost singular catastrophies of modern times'.[33] Although the name of William Tathamhas passed unnoticed in the annals of the Society, yet the present extensive trans-atlantic membership may well be regarded as a vindication of the policy which he had once advocated.

D. G. C. A.

1. J. P. Boyd, ed., *The Papers of Thomas Jefferson*, Vol. IV (Princeton, 1951), p. 241.

2. For the life of Tatham see S. C. Williams, 'William Tatham, Watuagan', *Tennessee Historical Magazine*, Vol. VII (1921), pp. 154–79 (issued in book form under the same title in 1923 and 1947); E. G. McPherson, 'Letters of William Tatham', *William and Mary Quarterly*, 2nd series, Vol. XVI (1936), pp. 162-91,

362–98. There are articles on Tatham in the *Dictionary of National Biography* and the *Dictionary of American Biography*. References to American sources have been kindly supplied by Mr. William M. Dietel and Mr. Whitfield J. Bell.

3. *The Annual Biography and Obituary for the year 1820* (London, 1820), p. 150.

4. In 1828 the Society's Library contained the following publications by William Tatham: (1) *Political economy of inland navigation, irrigation, and drainage* (London, 1799); (2) *An historical and practical essay on the culture and commerce of tobacco* (London, 1800); (3) *Communications concerning the agriculture and commerce of the United States of America* (London, 1800); (4) *National Irrigation, or the various methods of watering Meadows* (London, 1801); (5) *Report of certain impediments and obstructions in the navigation of the river Thames* (London, 1803); (6) *Remarks on the projected London canal and rail-road* (London, 1803); (7) *Circular architecture* (London, 1803).

See *Catalogue of the Library of the Society . . . of Arts* (London, 1828), pp. 132–3.

5. On Tatham's *Communications concerning the agriculture and commerce of the United States of America*, a reviewer wrote: 'The general impression we felt on reading this pamphlet was singular; it bears such constant internal proofs of American habits in the author, that we felt a sensation as if in a new world', *Commercial and Agricultural Magazine*, Vol. III (1800), p. 212. See also Vol. IV (1801), pp. 113–14.

6. *The Annual Biography and Obituary for the year 1820*, p. 157.

7. W. Tatham, *Report of certain impediments and obstructions in the navigation of the river Thames* (London, 1803), p. 119.

8. R.S.A. Loose Archives, A16/4. W. Tatham, 1801.

9. E. Lipson, *The Economic History of England*, Vol. III, 3rd ed. (London, 1943), pp. 185–6.

10. H. A. Innis, *Select Documents in Canadian Economic History, 1497–1783* (Toronto, 1929), pp. 369–72.

11. G. S. Graham, *British Policy and Canada, 1774–1791: a study in 18th century trade policy* (London, 1930), pp. 110–15.

12. [Royal] Society of Arts Minutes (hereafter Soc. Min.), 8th April, 1801.

13. For Governor Joseph Colen see J. B. Tyrrell, ed., *David Thompson's Narrative of his explorations in Western America*, 1784–1812 (Champlain Society Publication XII, Toronto, 1916), *passim*; E. Voorhis, *Historic Forts and Trading Posts of the French Régime and the English Fur Trading Companies* (typescript report to Department of the Interior, Ottawa, 1930), p. 123.

14. R.S.A. Loose Archives, loc. cit.

15. Ibid., A16/5, A16/14, A16/15. W. Tatham, 1802. Tatham felt himself 'bound to contribute every scrap in my power to the magazine of material which elucidates this interesting topic'. (Ibid., A16/15. W. Tatham, 1802.) On 15th January Tatham wrote another letter to the Society. His subject was the 'Silk Grass' of America. See ibid., R.B.279. W. Tatham, 1802. He also communicated some information on dyeing. See [Royal] Society of Arts, Minutes of the Committee of Chemistry, 19th February and 1st May, 1802.

16. [Royal] Society of Arts, Minutes of the Committee of Colonies and Trade (hereafter Min. Comm. C. & T.), 2nd Feb., 1802.

17. Premiums were given in 1804, 1806 and 1809, but the war of 1812 and the unfavourable climate prevented the crop from becoming established. See *Transactions of the Society of Arts*, Vol. XX (1802) pp. 62–3; Vol. XXI (1803), pp. 442–62; Vol. XXII (1804), pp. 345–62; Vol. XXIV (1806), pp. 156–63; Vol. XXVII (1809), pp. 221–8. C. F. Grece, *Facts and observations respecting Canada and the United States of America* (London, 1819), pp. 122; G. S. Graham, op. cit., pp. 114–15.

18. R.S.A. Loose Archives, A16/16–18, A16/20. W. Tatham, 1802; Min. Comm. C. & T., 30th April, 1803.

19. Soc. Min., 10th March, 1802.

20. Min. Comm. C. & T., 16th March, 17th April, 1802.

21. R.S.A. Loose Archives, D1/137. W. Tatham, 11th Feb., 1802. He received a vote of thanks for his gift (see Soc. Min., 17th Feb., 1802), but its accommodation presented a problem. See Min. Comm. Miscellaneous Matters (hereafter Min. Comm. Misc.), 23rd Feb., 1802.

22. R.S.A. Loose Archives, D1/138. W. Tatham, 17th March, 1802.

23. Ibid., A16/19. W. Tatham. 26th March, 1802. See D. G. C. Allan, 'Notions of Economic Policy Expressed by the Society's Correspondents and in its Publications, 1754–1847', *Journal*, Vol. CVII (1959), p. 217. The letter which accompanied the essay is now R.S.A. Loose Archives, D1/139. W. Tatham, 1802.

24. *Transactions of the Society of Arts*, Vol. XX (1802), p. 440. There is an article on Robinson in the *Dictionary of National Biography*. Of the eight proposed Corresponding Members the following may be found in the *Dictionary of American Biography:* Robert Fulton, Henry Lee, Benjamin Smith Barton, William Thornton, St. George Tucker. The others were Arthur Campbell, William Allen Dangerfield, and Samuel Latham. See R.S.A. Loose Archives, D1/140. W. Tatham, 1802.

25. Ibid., D1/141. W. Tatham, 1st April, 1802. In 1772, before the War of Independence, there were over forty American Corresponding Members in the Society, and in 1787 there was only one. The total had increased to two in 1817 and to three in 1837. See printed lists of members of the Society.

26. Min. Comm. C. & T., 17th April, 16th & 23rd Nov., 1802; 13th Feb., 1804; Min. Comm. Mechanics, 23rd March, 7th, 14th, 21st & 28th April, 9th, 12th, 14th, 25th & 30th May, 1803; Min. Comm. Misc., 24th March, 23rd & 30th June, 24th Oct., 1803, 9th March, 1804; Min. Comm. Manufactures, 23rd April, 30th May, 1804; Soc. Min., 24th Nov., 1802, 3rd Feb., 13th & 20th April, 4th May, 1st June, 1803.

27. Soc. Min., 3rd Feb., 1803.

28. Ibid., 4th May, 1803.

29. Ibid., 1st June, 1803.

30. Soc. Min., 13th April, 1803; Min. Comm. Mech., 9th & 23rd March, 7th April, 1803.

31. R.S.A. Loose Archives, A16/30. W. Tatham, 1804; Soc. Min., 25th April, 1804; Min. Comm. Man., 23rd April, 1804; *Transactions of the Society of Arts*, Vol. XXII (1804), p. 438.

32. S. C. Williams, op, cit., pp. 168–9.

33. *The Annual Biography and Obituary for the Year 1820*, p. 158.

NOTES ON BOOKS

MODERN RAILWAYS, THEIR ENGINEERING, EQUIPMENT AND OPERATION. *By Cecil J. Allen. London, Faber & Faber, Limited*, 1959. 45*s net*

For railways, the present is one of those critical times to which every industry comes. A distinguished nineteenth-century historian, much impressed by the golden prospects of steam and the rail, believed that during that century these would replace every form of road transport, and foresaw a time when something like a quarry puffer or a steam tram would move on the site of the humblest country by-road. In turn we can look forward and wonder what will happen to the oil industry if and when something like the Bacon cell replaces the petrol tank. Between the past, erroneous supposition and the as yet unrealized speculation, we look around at an industry that was conceived and built for a monopoly which it no longer has, for since then people have produced the motor car, the practical aircraft, the pipeline, the powerline, and for what it may be worth, the hovercraft. Even thirty years ago the eminent motoring pioneer Selwyn F. Edge was advocating the conversion of railways to motor roads, and he has had many imitators.

At present the position is that Great Britain, America and France, *inter alia*, are closing and lifting what once were quite important railways, while Russia and China,

which do not encourage multiple control of transport, are building thousands of miles of new ones. These circumstances demonstrate two points of view; one, that the railway is an outmoded thing no longer capable of self-support; the other, that it is a transport machine still without rival in the overland movement of people in mass and freight in bulk. Serious consideration of the latter is more to be recommended than easy assumption of the former. But, whichever the viewpoint, the advent of Cecil Allen's book is timely. It gives, in language that everyone can read, an extraordinarily—indeed an unprecedentedly—comprehensive account of this great and complex industry in its testing years, in the historically short years which come between the passing of its empire and the realization of its mechanical change—between the era of the hand-fired steam boiler and the manual locking frame and that of electronics and automation.

Now Allen is a railwayman, though retired. He is a metallurgist, for many years an inspector of materials on one of the world's greatest railways. He knows his railway as few men do—very few men, indeed, who also can write. Further, he loves, and has always loved, his railway, though fortunately that does not make him flout the rules of objective documentation. He does not entertain his readers with ancient history; he does not titivate them with his own ideas on future history. He simply shows railways as they are at present, in all their aspects. Most of the past has been polished off in 40 pages and thereafter the reader is plunged into study of every aspect of civil and mechanical engineering at home and in foreign parts (as one expected, Allen enjoys himself with mountain railways), with the steam locomotive as we have known it, in its design, handling and maintenance; of electric and the various forms of internal combustion traction, and of rolling stock construction and development. The author has had a sporting interest in speed at least since the days of Edward VII and he enjoys himself thereon too; be it remarked that it is one thing in surface transport to move a motor car at 100 m.p.h. and another—safely accomplished at that—to move several hundred passengers at the same speed and in the same single movement. Freight timetables and traffic control are all dealt with in the same clear, conscientious manner, and so are signalling and the mechanical and electrical sides of train control. Docks and harbours are also treated, though perhaps the maritime passages are more sketchy, as are those relating to staff and administration. The latter, anyway, come more within the historian's province, as do the human activities of any industry.

Allen's illustrations are peculiarly well chosen—the choice of a methodical man, documentary rather than artistic, though some, to be sure, are very fine. The curious reader would like to have seen something more from the less known, yet vast portions of the railway world now in the Soviet bloc countries, above all the lines of Russia—but goodness knows, the present writer, in the past quarter of a century, has found this a difficult source! Allen's style is of a part with his construction; he is workmanlike, not stately; he is comprehensive, never sensational. He must have written millions of words on railways apart from serving them. This, surely, is his *chef d'oeuvre*.

C. HAMILTON ELLIS

THE PREHISTORIC BACKGROUND OF INDIAN CULTURE. *By D. H. Gordon. Bombay, Bhulabhai Memorial Institute,* 1958. 40*s net*

The Bhulabhai Memorial Institute is to be congratulated on sponsoring this book by Colonel Gordon, whose many years of research during a lifetime's service in India have particularly fitted him to be the author of a consecutive account of Indian prehistory; but the fact that it can now be done at all is due to the immense strides made in recent years by workers in this field. Since the last war, the vertical investigation of many sites throughout the sub-continent is at last revealing the general outlines of India's past, and although little progress has been made with the barren epochs represented by the earliest stone industries, the perplexing break in continuity

after the middle of the second millenium B.C. is rapidly being filled in. However, some of the central problems, such as the exact nature of Aryan expansion in the North during these so-called dark ages, or the origin of the Dravidians and their relationship with the Megalithic communities of the peninsular, still await solution. Not all of the excavated material has been properly assessed and there are still important sites needing even preliminary investigation. Thus the picture to-day cannot remain unchanged for long and the vast amount of horizontal digging required to fill out the details will necessarily affect the general pattern as well.

Given this very shaky foundation, with most of the earlier work based on fumbling excavation methods and too much of the recently dug material still buried as far as everyone but the excavator is concerned, the author has succeeded in building up a remarkably comprehensive view of Indian prehistoric development. No other book available at present gives such a full survey of the entire field, and where much remains speculative one cannot fail to be grateful for the fact that this has exercised Colonel Gordon's talent for stimulating discussion, expressed in down to earth terms.

In his first two chapters he deals briefly with the rather dull vestiges of palæolithic and later stone industries before turning to the farming communities of Baluchistan, linked to Iran both by their pottery types and their geographical situation. These cultures, along with the still enigmatic Indus valley civilization, are now in Pakistan, and because of this and their West Asian affinities there is perhaps a tendency towards their neglect to-day by Indian archæologists, who are currently more interested in the extension of this culture into Gujarat. The present book maintains the correct balance and gives a chapter each to the hill farmers and to the urban dwellers of the plain, whose civilization is here terminated with a little more finality than Indian investigators would have it. Apart from Lothal, the author is reluctant to accept the alleged Harappan sites in Kathiawar as truly belonging to this culture.

Dealing with the often neglected or misunderstood rock paintings, of which he has made a special study, Colonel Gordon effectively disposes of any suggestion of an early date and places most of the material between the fifth and tenth centuries A.D. Even this seems optimistic with regard to some of the material, and it is very likely that later parallels could be found that would be no less convincing than those produced.

The most controversial aspects of the final chapters are the author's plausible late datings for the important grey and black wares found at such sites as Hastinapura, and the retention of his earlier theory that iron and megaliths in association with red-and-black ware may have spread northwards over the peninsular as a result of Chola expansion. Here we are on ground that invites recourse to literary as well as material remains, and as the author himself warns, 'the difficulty of reconciling in any reasonable way the archæological facts with the culture setting visualised by legends and tradition . . . is quite insuperable'. There are indications that the spade will decide such questions before very long.

ROBERT SKELTON

ATLAS OF AUSTRALIAN RESOURCES: *Dominant Land Use; Population Increase and Decrease*, 1947–54; *Educational Facilities; Health Services; Ports and Shipping. London, Angus and Robertson*, 1959. 10*s* 6*d each*

With the ever-increasing pressure of population on land resources, the nations of the world are becoming aware of the vital necessity of a stocktaking and the publication of the results in map form as a National Atlas. To see thus visibly portrayed the present position is to invite inquiry into reasons, and so to see what trends exist to be encouraged or discouraged in national planning for the future. The Australian Department of National Development planned an Atlas of 30 maps with commentaries, all on the uniform scale of 1:6,000,000 or 94.7 miles to one inch. Five have recently been issued to add to the 20 previously published.

The map of Dominant Land Use has twelve categories, four concerned with beef cattle, three with sheep and cereals. It is in fact an economic map in that it stresses the main occupation of the farmers, irrespective of the quantity or the value of the commodities produced. A third of the continent is coloured as having 'no significant use' and this, surprising as it may be, includes the best watered parts of the north-west coastlands and Cape York Peninsula. 'Timber with occasional grazing' is indicated as covering very large areas in the south-east, south-west and Tasmania. The famous 'wheat belt' becomes 'wheat or other cereals with wool and fat lamb', and its area is less extensive than on older maps.

The last map needs to be studied side by side with the map of Population Increase and Decrease, 1933–47. This is a map which can only be called staggering—a young country, a vast country recently topping the 10,000,000 population mark yet with practically every rural area showing a decrease. Urbanization and rural depopulation may be world-wide phenomena, but it must be doubted whether any country in the world approaches Australia in the magnitude of the problems this map presents.

The map of Educational Facilities (though it shows only educational institutions above primary level) indicates both a consequence and perhaps a partial cause of rural depopulation. In the vast interior, education scarcely exists. There is nothing marked over the two thousand miles of coastlands from Darwin to Carnarvon; even old-established centres like Cloncurry and Oodnadatta, both on railways, lack any facilities. The map of Health Services presents a happier picture. The bases of the famed Flying Doctor Service are marked and one is made to realize that a 500-mile trip cannot be unusual. Indicated by separate colours are 'Bush Nursing Hospitals' and 'Leprosaria'—incidentally, the latter is a word not in the *Oxford English Dictionary*.

The map of Ports and Shipping needs careful study. Although the concept of a port hinterland is simple enough, the delimitation of a hinterland and its portrayal on a map are a different matter. However, the attempt is made, and the results are interesting, especially where they suggest how important are state boundaries, such as that between Queensland and New South Wales. If Brisbane and Sydney-Newcastle do not poach on one another's territories, the old limitation imposed by railway gauges must still be an important factor.

In all this is a fine set of maps, skilfully thought out and prepared, well presented and printed.

L. DUDLEY STAMP

SHORT NOTES ON OTHER BOOKS

PORTRAIT PAINTING IN OILS. *With a Constructive Method of Drawing the Head and Neck. By Herbert Holt. London, Pitman,* 1959. 30*s net*

This covers all aspects of portrait painting, including anatomy, materials, colour, design and professional work. Particular stress is laid on the importance of being able to analyse and draw the basic construction of the head, and the author s own method, based on his long teaching experience, is fully described and illustrated.

ROMAN LETTERING FOR STUDENTS. *By James Bostock. London, The Studio,* 1959. 7*s* 6*d*

This useful manual sets forth in its simplest form the roman alphabet as it stands to-day, so that it may serve the student as a basis for his study of lettering, and provide a good foundation for his development of particular styles of letter shapes suited to specific purposes. Considering its standard of production, the work is reasonably priced.

LIBRARY ADDITIONS

Fellows and Associates are reminded that they may borrow up to five books at a time from the Library and retain them for a month. Members living outside London may borrow books by post. Books sent by post are despatched at the cost of the Society and returned at the cost of the borrower. Books marked with an asterisk are part of the reference library, and not normally available for loan.

INDUSTRIAL AND COMMERCIAL ART AND DESIGN

MILAN, PREMIO LA RINASCENTE COMPASSO D'ORO—Gio Ponti, il disegno industriale, con una nota di Mario Làbo. *Milan, La Rinascente*, 1958. Presented by the publishers.

MILAN, PREMIO LA RINASCENTO COMPASSO D'ORO—The Museum of Modern Art, New York. Preface by Sir Herbert Read, text by Arthur Drexler, chronicle by the Museum staff. *Milan, La Rinascente*, 1958. Presented by the publishers.

NYMAN, B.—Illustrated catalogue in two volumes of the Nyman collection of cameo glass, porcelain enamelling and pate-sur-pate. *Church Hill, Epping, B. Nyman*, 1957. Presented by the author.

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SAVAGE, GEORGE—Pottery through the ages. *Harmondsworth, Penguin Books*, 1959.

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GRISWOLD, A. B.—Dated Buddha images of Northern Siam. *Ascona, Switzerland, Artibus Asiae*, 1957. Presented by Mr. T. S. Lyndon-Haynes.

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LISSIM, SIMON—The art of Raymond Lister; with a foreword by L. G. G. Ramsey. 10 *Green St., Cambridge, John P. Gray & Son*, 1958.

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from the Tate Gallery and the Victoria and Albert Museum. *London, H.M.S.O.*, 1958. (*Illustrated booklet—No.* 8.)

PENROSE, ROLAND ALGERNON—Picasso: his life and work. *London, Gollancz*, 1958.

RICHARDSON, JOHN—Georges Braque. *Harmondsworth, Penguin Books*, 1959. (*Modern painters series.*)

RICHMOND, LEONARD—Landscape composition in colour. *London, Pitman*, 1959.

BIOGRAPHY

RAE, ISOBEL—The strange story of Dr. James Barry, army surgeon, Inspector-General of Hospitals, discovered on death to be a woman. *London, Longmans, Green*, 1958. Presented by Dr. James Barry.

HISTORY AND TOPOGRAPHY

*BURKE, *Sir* BERNARD—The general armoury of England, Scotland, Ireland and Wales; comprising a registry of armorial bearings from the earliest to the present time. *London, Harrison*, 1884.

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WINSTONE, REECE—Bristol as it was: 1939-1914. 23 *Hyland Grove, Henbury Hill, Bristol, R. Winstone*, 1957.

WINSTONE, REECE—Bristol to-day; the photographs taken by, and the book written, designed and published by Reece Winstone. 23 *Hyland Grove, Bristol, R. Winstone*, 1958.

FROM THE JOURNAL OF 1860

VOLUME VIII. *17th February*

THE JACQUARD LOOM

From a paper 'On Figure Weaving by Electricity', read by Peter Le Neve Foster (then Secretary of the Society) on 15th February.

Jacquard was a native of Lyons; by trade a straw hat manufacturer.* His father was a weaver; and young Jacquard, being forcibly impressed with the imperfections of the cumbersome and ill-constructed loom of that period, as well as the tedious and painful labour required for its working, and the small remuneration which it afforded, had early determined not to take up his father's occupation. Though apprenticed to the straw hat trade, his mechanical talent did not lie dormant. A reward was for many years offered by this Society for the invention of a machine for the weaving of fishing nets, and a portion of the Society's premium list to this effect having been copied into a French newspaper, it was seen by young Jacquard, who immediately set his brains to work and, after numberless essays, succeeded in accomplishing the object, and a model was made. This model, unknown to Jacquard, through the agency of a friend to whom he had lent it for inspection, was taken to Paris, where it came under the eyes of Napoleon I, then First Consul. Some weeks afterwards, much to his astonishment, he was summoned before the Préfet, who informed him that, by order of the First Consul, he must at once start for Paris, and that a post-chaise, with a gendarme to compel his attendance, was in readiness to take him there. Jacquard, somewhat alarmed, had no choice, and immediately on his arrival in Paris was taken to the Conservatoire des Arts et Métiers, where he was brought into the presence of Napoleon, and of Carnot, then prime minister. The latter, addressing him in a brusque tone, said:—'Is it you who pretend you can do what no one else can accomplish—tie a knot in stretched cord?' Jacquard, surprised by the tone of the speaker, and awed by finding himself in the presence of such high personages, did not immediately reply. Napoleon, however, with that tact and suavity which he could so readily assume, having asked a few trivial questions, led him by degrees into an animated conversation, and Jacquard was at once installed at the Conservatoire, where he had ample means of cultivating and developing his mechanical talents. His first work was to complete a full-sized machine of the fishing-net loom, which when completed gave general satisfaction. He however never gave up his early and long cherished idea of constructing a loom which should ameliorate the condition of the weavers of his native town. A magnificent shawl, destined for Josephine, had been wrought in a loom of a very complicated nature, which had cost, it is said, more than twenty thousand francs. This loom, the invention of the celebrated Vaucanson, was placed under Jacquard's charge for repair, when he pointed out that he could readily effect its object by much more simple means, and he soon completed a machine in which he succeeded beyond his most sanguine expectations. In 1801, the Jacquard loom was exhibited at the National Exhibition, in Paris. The French Government rewarded him with a pension of a thousand crowns for his discovery, and Jacquard felt assured that he should have no difficulty in establishing the loom

* In an anonymous French work, he is said to have been apprenticed to a bookseller; but the statement in the text is given on the authority of Sir John Bowring, in his evidence before a Parliamentary Committee on the Silk Trade.

in his native city; but mark the treatment he then received. Having, at his own expense, constructed a loom, the Conseil des Prud'hommes were invited to inspect it and give their opinion. Great was Jacquard's dismay when he found they not only opposed the introduction of his loom, but gave orders for its public destruction, which was immediately carried out in the Place, amidst the shouts and rejoicings of the populace, and his invention excited such enmity against him amongst the weavers, that he three times narrowly escaped with his life. Nevertheless, in a few years, from the increasing competition with the English, the prejudice of the French began to give way, and in self-defence they were compelled to adopt the loom they had previously despised and rejected.

Some Activities of Other Societies and Organizations

WED. 27 JAN. Architects, Royal Institute of British, 66 Portland Place, W.1. *Practical fire protection.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. A. Clow : *The oral presentation of scientific material.*

FRI. 29 JAN. Chemical Society, at University Chemical Laboratory, Lensfield Road, Cambridge. 8.30 p.m. Dr. J. C. Kendrew : *The structure of myoglobin.*

TUE. 2 FEB. British Interplanetary Society, at Caxton Hall, S.W.1. 7 p.m. A. Wilson : *The use of reinforced plastics in rockets.*

Plant Engineers, Institution of, at the Royal Society of Arts. 7 p.m. P. T. Fletcher : *Potentialities of nuclear power.*

Radio Engineers, British Institution of, at the University Club, Liverpool. 7 p.m. A. W. Mews : *Distribution of sound and television by wire.*

WED. 3 FEB. Analytical Chemistry, Society for, at Chemical Society, Burlington House, Piccadilly, W.1. 7 p.m. D. Chapman : *Spectroscopic investigation of fats.*

Petroleum, Institution of, 61 New Cavendish Street, W.1. 5 p.m. Y. P. Wilson : *Regional trends in crude oil gravities in the Middle East.*

THURS. 4 FEB. Chemical Industry, Society of, at Gas Showrooms, Parliament Street, Nottingham. 7.30 p.m. Dr. T. H. Morton : *The soiling of textile materials.*

Radio Engineers, British Institution of, at College of Technology, Sackville Street, Manchester. 6.30 p.m. E. S. Benson : *Acoustics in modern buildings.*

MON. 8 FEB. Royal Geographical Society, 1 Kensington Gore, S.W.7. 8.30 p.m. H. J. B. Harding : *The Channel tunnel.*

Transport, Institution of, at R.I.B.A., 66 Portland Place, W.1. 5.45 p.m. Air Chief Marshal Sir Denis H. F. Barnett : *R.A.F. Transport Command.*

TUES. 9 FEB. University College, London, Gower Street, W.C.1. 1.15 p.m. Andrew Forge : *Painting since the war.*

WED. 10 FEB. Engineering Inspection, Institution of, at Royal Society of Arts. 6.15 p.m. D. C. W. Jowers : *Automation and computation.*

Radio Engineers, British Institution of, at the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle. 6 p.m. Raymond E. Ross : *Instrumentation in rocket propulsion.*

THURS. 11 FEB. Chemical Society, at Royal Institution, Albemarle Street, W.1. 7.30 p.m. Professor P. L. Pauson : *Hydrocarbon-metal carbonyls.*

TUES. 16 FEB. Architects, Royal Institute of British, 66 Portland Place, W.1. 6 p.m. Dr. R. G. Hopkinson and John Bickerdike : *Freedom in lighting design.*

Locomotive Engineers, Institution of, at Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1. 5.30 p.m. A. Gordon Wilson : *Trends in transmission design for self-propelled diesel railcars.*

University College, London, Gower Street, W.C.1. 1.15 p.m. K. Ridgway : *Problems of early steam engine design.*

WED. 17 FEB. British Kinematograph Society, at Colour Film Services Ltd. Theatre, 22–5 Portman Close, Baker Street, W.1. 7.30 p.m. W. H. Cheevers : *Modern television studios.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 6 p.m. E. A. Watson : *Electrical equipment of the automobile.*

THURS. 18 FEB. Analytical Chemistry, Society for, at Birmingham. 2.30 p.m. Symposium : *Food analysis.*

Anthropological Institute, Royal, 21 Bedford Square, W.C.1. 5.30 p.m. Dr. C. Hooykaas : *Two exorcist priests of Bali.*

FRI. 19 FEB. Royal Geographical Society, 1 Kensington Gore, S.W.7. 5.15 p.m. Symposium : *Space navigation.*

TUES. 23 FEB. Interplanetary Society, British, at Royal Society of Arts. 7 p.m. R. H. B. Forster and L. Breen : *Some problems encountered in the design of large rocket test beds.*

WED. 24 FEB. Foundrymen, Institute of British, at Constitutional Club, Northumberland Avenue, W.C.2. 7.30 p.m. G. R. Webster : *Modern British bath-making practice.*

Radio Engineers, British Institution of, at London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1. 6.30 p.m. Dr. D. F. Stott : *The unification of electronic clinical instruments.*

THURS. 25 FEB. Chemical Society, at Imperial College of Science and Technology, South Kensington, S.W.7. 7.30 p.m. Professor N. A. Sorensen : *Some glimpses into the variations which nature brings about in acetylenic compounds.*

University College, London, Gower Street, W.C.1. 1.15 p.m. B. Schlaffenberg : *The American town to-day.*

MON. 29 FEB. Chemical Industry, Society of, at 14 Belgrave Square, S.W.1. 5.30 p.m. Dr. E. G. Cockbain : *The colloidal stability of natural rubber latex.*

Royal Geographical Society, 1 Kensington Gore, S.W.7. 8.30 p.m. A. J. Cain : *The Oxford University expedition to British Guiana.*